BIOLOGICAL AND SUBJECTIVE RESPONSES TO MINORITY STATUS AND SOCIAL EXCLUSION IN THE WORKPLACE: A GENDERED PERSPECTIVE

by Catherine Jeanine Taylor

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A Dissertation

Presented to the Faculty of the Graduate School

of Cornell University

In Partial Fulfillment of the Requirements for the Degree of

Doctor of Philosophy

by

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August 2010

BIOLOGICAL AND SUBJECTIVE RESPONSES TO MINOIRTY STATUS AND SOCIAL EXCLUSION IN THE WORKPLACE: A GENDERED PERSPECTIVE

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Cornell University 2010

In this dissertation I use a mixed-method approach to advance sociological understanding of the relationship between social integration, minority status by sex and socially induced stress response. I conduct two studies to addresses gaps in the literature on workers who are in the minority by sex in their occupation or workplace. Several compelling case studies have found that women in the minority in the workplace on the dimension of sex (i.e., tokens) encounter negative workplace social environments. In contrast, some work has found that men in the minority in the workplace on the dimension of sex encounter positive workplace social environments. In Study 1 I use nationally representative survey data to demonstrate that the social experience of workers documented in these case studies is widespread and also occurs at the occupational level. In Study 2 I utilize two laboratory experiments to demonstrate the physiological effects of the social experiences of women in the minority by sex. I find that the social environment encountered by women in the minority in the workplace results in a biological stress response among both men and women in a laboratory setting. This finding provides evidence that the social environments encountered by these women can have negative repercussions in terms of stress response. It also provides evidence for the theoretical position that sex differences in behavior between men and women are caused by structural and interactional level phenomena – rather than by biological differences between the

sexes. I also find that the relationship between biological stress response and perceptions of status in a group vary in gendered ways. Specifically, men evidence a relatively high biological stress response when they perceive that they are seen as low status by group members who are women. I speculate that the interaction between social structures and individual biological response might interact to re-create structures of inequality. I theorize that social arrangements influence biological outcomes, which in turn contribute to the reproduction of social inequality. In addition I note that the stress processes I document will likely have health implications for minority group members.

BIOGRAPHICAL SKETCH

Catherine Taylor received a BA in Economics from Smith College and an MA in Human Development from Cornell University. Catherine grew up in Medford and Grants Pass, OR. She has also lived in Northampton, MA; San Francisco and Los Angeles, CA; Sisters, OR; and Barcelona, Spain.

This dissertation is dedicated to Susan Cosentini, Cindy Krystoff, Lidija Sekaric and Christopher Taylor—my very favorite token men and women.

ACKNOWLEDGMENTS

I would like to express my gratitude to those who have assisted me in completing my dissertation. My advisor Shelly Correll was an ideal mentor throughout my graduate career. I appreciate her support and coaching through the process of writing this dissertation well as for earlier projects. She has always been very influential in my work. I also appreciate the support and insight of Elaine Wethington and Edward Lawler, my other two committee members. I feel very fortunate to have had such a wonderful group of academic mentors. I also want to thank Kim Weeden and Karl Pillemer for their financial and academic support throughout my last several years at Cornell. Thank you also to the faculty of the Department of Sociology for their time, advice and insights regarding my work. Ned Place also deserves a special acknowledgement for being so generous with space in his freezer in the first years of the cortisol collection project. Thank you also to my fellow graduate students here at Cornell—especially Makeba Wilbourn and Steve Mock for getting me through the first half and Jenny Todd, Christin Munsch, Sarah Thebaud, Youngjoo Cha, Emily Hoagland and Trey Spiller for getting me through the second half. Thank you finally to the 55 research assistants who helped me collect the cortisol data: Sam Rosen, Sam Saad, Peter Cook, Steve Matthews, Dave Mahler, Mickey Pearlstein-Gluck, Jess Law, Hannah Shamji, Lindsay Gerolimatos, Alan Goldberg, Dan Asmat, David Sharon, Emily Lyon, Greg Clother, Christy Kidner, Tory Bredt, Jake Kresovich, Nick Tripoli, Mary Schilling, Heather Griffis, Lizzie Goldblatt, Dan Gunz, Erin Litwin, Stanley Gartshein, Tanya Olsefski, Aimee Yanno, Jose Gonzales, Julia Pennisi, Elyse Finkel, Andrea Forrest, Angela Morel, Olena Pazderska, Renata West, Matt Henry, Danielle Farrell, Fedor Dokshin, Lynn Kim, Christopher David, Gabe Sulkes, Courtney Chan, Ashley Krooks, Melissa Kim, Labrini Godevas, Catrina Dwyer, Agne Sasnauskaite, Brittany Bettman, Andrew Bernstein, Jordan Bernstein, Brynne Calleran, Angelica

Catalano, Melinda Cobian, Elissa Rosenberg, Agne Sasnauskaite, Karen Wolf and Emily Hoagland

I also appreciate the support of family in my educational endeavors. Thank you to my parents and grandmother, Ann Wright and Jan and Nik Taylor, for all of their financial and emotional support of my education throughout the years. I feel so lucky to have been born into your care. Thank you also to my step-father Larry Wright for his support and encouragement. Thank you to my brothers and sisters: Nicole, Ken, Chris and Ryan. Having you in my life is such a blessing – you make me so happy. Finally thank you to my beautiful and amazing wife, Amy Gonzales. Without you, I would not have finished on such a good note.

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CHAPTER 1

INTRODUCTION

This dissertation is broadly concerned with the ways in which sex composition affects workplace experiences and outcomes. I focus in particular on women workers because they often experience negative outcomes in male-dominated work environments (Kanter 1977; Pierce 1995; Roth 2006). And these negative outcomes are important because they are related to broader economic inequality between men and women (Glass 1990; Jacobs 1989; Petersen and Morgan 1995; Reskin and Roos 1990).

At the most macro-level this project asks how the sex compositions of occupations matter. At the most micro-level I focus on small group interactions, examining the experiences that women have in workplace teams and groups. Much of the previous work on the relationship between sex composition and women's outcomes focuses on the intermediate level or does not disentangle intermediate-level, macro-level, and micro-level effects (that is, the occupation level, the firm level, small work groups, etc). This previous work is highly important as it has contributed empirical knowledge and a theoretical framework for understanding the relationship between sex composition and gendered economic inequality. Here I contribute to this general project by looking more closely at how sex composition matters at the macro-level of occupations and at the micro-level of small work groups. By taking this approach I am able to focus specifically on the effects of sex-composition at different levels of the work sector.

With this approach, I find that negative workplace experiences for women in male-dominated work environments are widespread and likely cause a biological stress response. I also find that this stress response occurs among both women and

men, when men are exposed to the same negative social environment that women in male-dominated workplaces often encounter. This provides evidence for a central tenet of work in the sociology of gender which argues that observed differences between women and men are based more on differential gendered social conditions than on physiological differences between the sexes (Epstein 1988). Finally, this approach provides further insight into understanding economic inequality between women and men as well as for understanding broader social structures and processes of interest to sociologists. In particular, I examine status processes which are activated in social environments in which status hierarchies are salient.

Tokens and Occupational Minorities

Kanter (1977: 207) first called both women and men who were in the numerical minority in the workplace based on their sex "tokens" to refer to these individuals' statuses as symbols of their gender. I use Kanter's definition of token in this project.[1] I also draw on Kanter's concept of a "token" to introduce a related term—"occupational minority". An occupational minority is a worker who is a numerical rarity in his or her occupation (for example, men who are nurses or women who are engineers). This concept of occupational minority differs from the classic usage of "token", which is typically defined at the firm or workplace level (Kanter 1977). Occupational minorities, by contrast, are minorities at the national (occupational) level regardless of the actual sex composition of their workplaces. As such, the concept of occupational minority explicitly theorizes the workplace effects

[1] I do not use the term "token" to refer to other kinds of minorities, such as racial or ethnic minorities, though some of the effects I find would likely appear in other minority groups.

of cultural ideals associated with working in a male- or female-dominated occupation independent of organizational characteristics.

This definition of an occupational minority overlaps in many cases with that of the token. For example, a woman working as a professor in a physics department likely works with mostly men, and most physics professors in the United States are men. This woman is both an occupational minority and a token. However, it is problematic to assume that occupational sex composition is always mirrored at the firm level (Roos and Reskin 1992). A worker may work in a firm with other workers mostly of his or her own sex, although most workers in his or her occupation are of the opposite sex (for example, a woman surgeon in a medical practice with other women physicians). However, despite her firm-level sex similarity to her coworkers, the woman surgeon's workplace experience will likely have many elements in common with that of the woman physics professor. In both work environments, coworkers draw on gendered cultural ideals about which types of occupations are appropriate for which sex. These ideals—which mark women as less suited for careers as physics professors or surgeons—may in turn mean that both women perceive that they lack access to work-relevant information and assistance from others in their workplaces.

In this dissertation I draw on the concept of minority status by sex in the workplace at two levels: (1) the occupational level and (2) the workgroup or firm level. I use the term "occupational minority" to refer to women and men who are in occupations that are mostly populated by members of the opposite sex. I use the word "token" to refer to women and men who are working in groups or firms mostly populated by members of the opposite sex. I describe two studies: one which addresses the experiences of occupational minorities (Study 1) and the second which address the experiences of token members of small work groups (Study 2).

Overview of Dissertation

I examine the experiences of both women and men working in occupations that are non-traditional for their sex; the social stressors that women working in male-dominated occupations, firms, or workgroups encounter in the workplace; and how these stressors may work to subvert gender equity in the workplace. I draw on research from social and biological sciences that documents how the social environment of male-dominated occupations and workgroups could be a stressor for women and how this stressor could negatively impact women. In particular, I focus on the effect of the social exclusion often faced by women in male-dominated occupations and workplaces (Kanter 1977; Roth 2006). In this project I address six related questions[2]:

(1) Do occupational minorities report different social environments than workers who are not occupational minorities?

(2) If so, does this vary by the sex of the worker?

(3) Does the workplace social environment reported by token women cause a stress response?

(a) If so, which components of the social environment of tokens cause a stress response?

(b) If so, does this stress response vary by sex?

(c) When in the token position is it low—or high—status actors that are especially responsive to threats to status in the group?

To address these questions I use a mixed methods approach. I employ both an analysis

[2] A more in-depth discussion of the relationship of these questions to each other is addressed in the text related to Figure 1, below.

of nationally representative survey data (Study 1) and two laboratory experiments (Study 2).

Study 1: The Workplace Environments of Occupational Minorities

In Study 1 I use nationally representative survey data to document the association between occupational-minority status, sex and perceived levels of workplace support. Drawing on previous empirical and theoretical work, I expect that occupational-minority men will report higher levels of workplace support than any other group of workers and that occupational-minority women will report lower levels of workplace support than any other group of workers. Previous ethnographies and interview studies have provided evidence that both occupational-minority women and token women experience low levels of workplace support (Kanter 1977; Pierce 1995; Roth 2006). However, these studies have not been able to demonstrate that this occurs widely and across many occupations. Taken together with previous ethnographies and interview studies of workplace tokens, Study 1 provides evidence that being either a token or an occupational minority is associated with a negative social environment for women and a positive social environment for men (Kanter 1977; Pierce 1995; Roth 2006; Williams 1995).

Study 2: Stress Response to the Negative Social Environment Encountered by Token Women

In Study 2 I use an experimental approach to document the consequences of the negative social environment encountered by token women. I am especially interested in the social exclusion reported by many token women (Pierce 1995; Roth

2006). Specifically I address the question of whether workplace social exclusion on the basis of sex can be seen as a stressor.

I use the term social exclusion to mean "rejection from social groups or relationships" (Baumeister et al. 2005: 591). I refer to a constellation of social experiences in the workplace that reflect a general perception by the worker of a lack of social integration into the workplace, both formally and informally. Social exclusion includes a lack of access to important work related information, low levels of perceived support for both work related and personal problems, and a lack of access to both instrumental and expressive network ties (Ibarra 1993; Krause 2001). Excellent case studies have documented that token women feel more socially excluded in the workplace than other workers and that this exclusion may limit their advancement (Kanter 1977; Pierce 1995). However research has not demonstrated the consequences of this exclusion, in terms of stress exposure, on token women.

Stress exposure is important to understand because there are sociological implications to stress response which results from being in the minority and being subjected to negative social treatment (such as social exclusion). Sociologists provide many examples of how negative social environments can cause stress, aversion and anxiety for minority group members (for example, Aries and Seider 2005; Feagin 1991; Hamilton 2007; Massey and Denton 1993). These, and other, scholars have demonstrated relationships between negative social environments and larger social structures and patterns. For example, Massey and Denton (1993) argue that African-Americans' responses to racism are a causal factor in residential segregation by race.[3] However, previous sociological studies have not attempted to document the

[3] It is important to note that Massey and Denton (1993) were not engaging in a "blame the victim" type of explanation for residential segregation by race. Rather, they were explaining how the racist actions of whites who preferred not to live near African-Americans created (among other things) a socially hostile environment in which it was untenable for African-Americans to reside.

physiological stress caused by racism and other negative social interactions encountered by minority group members. This stress response can be thought of as a motivation for some of the actions in response to discrimination, and other types of negative social treatment, among minority group members.

In this study I address this missing link by documenting that the social exclusion of a minority member of a group can result in a physiological stress response. I hypothesize that many minority group members experience these kinds of stress responses to a variety of negative social experiences arising from racism, homophobia, classism, sexism, etc. And that individuals' responses to the experience of stress can be seen as causally related to larger social patterns of interest to sociologists (for example, residential segregation by race, occupational segregation by sex, educational inequality, social movements, etc.).

An important component of the stress response of minority group members may be related to status hierarchies. For example a member of a minority group that is typically seen as lower status than the majority may have an especially strong stress response to having that low status be made salient through social processes such as sexism, racism or homophobia. On the other hand there are some cases in which the minority member of a group has higher status in the group. For example, a white man who is supervisor among white women subordinates. Or, a social environment like apartheid-era South Africa had this structure. That is members of the minority group were seen as higher status than the majority group. In this type of environment a member of a higher status group (for example the supervisor who is a white man) may evidence an especially high stress response if his taken-for-granted high status is threatened by one of his women subordinates. For example, the supervisor might have a stress response if one of his subordinates were to question his competence or authority regarding an important matter in the workplace. The effects of group

composition and status hierarchies are important topics in the field of sociology. In this project I link stress response to experiences in groups of various compositions of actors from different levels of status hierarchies.

In order to narrow the larger issues discussed above, I focus specifically on the question of the experiences of women in male-dominated work environments in Study 2. Specifically, I am interested in documenting the relationship between stress responses and being in the minority while experiencing negative social interactions. In order to do this—using an experimental setting—I expose participants to one type of social exclusion that token women experience in the workplace. I then measure participants' levels of stress response to this type of social exclusion. In addition I address the question of whether there are sex differences in stress response to social exclusion in a workplace setting.

I also address two potential causes of stress response related to status in a group. First, I argue that having ones' low rank on a status hierarchy made salient by group composition or by social interaction may cause a stress response. Second, I argue that threats to the status of actors who rank high on a social hierarchy may cause stress response—especially when those threats are perceived to originate from actors who rank lower on a status hierarchy. I provide evidence that, under conditions of social ambiguity, high status tokens are especially responsive to a perception that their status is being threatened by lower status group members.

In order to address these questions I designed two laboratory experiments in which I placed participants either in the majority or in the minority in a group and then measured the participant's stress response as well as their perceptions of their status in the group. In these experiments both men and women work in either a same-sex or an opposite-sex group. In Experiment 1 (of Study 2) participants who are in the opposite-sex group are subjected to social exclusion that is modeled on the specific type of

social exclusion that is reported by token women in several ethnographies and interview studies (Kanter 1977; Pierce 1995; Roth 2006).[4] I call this "gendered social exclusion" and it is characterized as making stereotypical ideas about the differences between men and women salient in the process of socially excluding token women. In Experiment 2 (of Study 2) participants who are in the opposite-sex group are *not* subjected to gendered social exclusion. In both Experiments 1 and 2, participants in same-sex groups are also not subjected to gendered social exclusion.[5]

The experiments were designed to measure stress response to two elements of the social experiences of token women. The experiences of token women can theoretically be divided into two distinct components: (1) the negative social environment they face and (2) minority status. Qualitative research demonstrates that both of these components occur simultaneously for token women. However, it is not known whether being in the minority on the dimension of sex—but not being exposed to a negative social environment can cause stress and discomfort for token women. In order to determine exactly which elements of the experience of token women can cause a stress response I isolate each of these components in a laboratory setting. In the experiments I expose participants to (1) being in the minority by sex and being subjected to gendered social exclusion, (2) being in the minority by sex and *not* being subjected to gendered social exclusion and (3) being in the *majority* by sex and *not* being subjected to gendered social exclusion. Using this approach I can begin to identify the specific components of the experiences of token women that cause a stress response. In addition I use these different conditions to determine under which social arrangements low and high status actors will be most responsive to perceived threats

[4] That is, I utilize the laboratory setting to subject both *women and men* to the social experiences reported primarily by *token women* outside of the laboratory. I discuss this further in Chapter 2.

[5] Participants in the same-sex group and not subjected to gendered social exclusion are control participants in both experiments.

to status and/or to status being made salient.

In the experiments I utilize a measure of a hormone (cortisol) that increases in humans in stressful situations—especially in situations involving social stress (Dickerson and Kemeny 2004). I use cortisol change as a response measure because it can document a physiological stress response. And a physiological measure of stress response is less susceptible to response bias than subjective appraisals of stress response. In addition cortisol response is not typically correlated with subjective measures of stress and distress (Nicolson 2008). For these reasons, cortisol response is often seen as a more legitimate measure than—or at least an empirically distinct construct from—self-report measures of stress response. In addition chronic exposure to cortisol response has been linked to negative health outcomes and thus has important repercussions beyond the workplace setting.

Case studies have demonstrated that token women do feel stressed and alienated. However, these studies are sometimes dismissed with claims that these women are being "overly sensitive". Experiments that demonstrate biological stress response to this kind of treatment can provide evidence of the potentially harmful effects of social phenomena associated with being a token woman. Furthermore, case studies cannot identify the specific processes that may cause stress response in token women. Are token women reacting to the active social exclusion by colleagues that has been reported in ethnographic and interview studies? Or, will token women experience stress in the workplace from being in the numerical minority alone? Without isolating these processes in an experimental setting we cannot understand which process is likely to cause a stress response.

Understanding more about the social stressors encountered by women in the minority in the workplace (and the repercussions of those stressors) can provide insight to managers and policymakers trying to create effective interventions for

recruiting women into, and retaining women in, male-dominated occupations and workplaces. Integration of women into male-dominated occupations and workplaces is an important issue because economic inequality between men and women can be partially attributed to occupational sex-segregation (Glass 1990; Petersen and Morgan 1995). In addition, social scientists across disciplines are increasingly interested in the links between social and biological processes (Booth, Carver, and Granger 2000; Cacioppo and Bernston 2006). In this project I collected both biological and self-report measures of social exclusion and of stress response to the social environment encountered by women in the minority. As such, this project has the potential to bridge disciplinary gaps by examining the biological effects of social processes.

Summary

While case studies and nationally representative data can provide compelling evidence of the associations between token status and phenomena such as social environments at work they cannot determine the mechanisms that cause this association. In contrast, an experiment is uniquely qualified to identify mechanisms and establish a causal relationship between factors. Experiments can document, in a controlled laboratory setting, the biological stress response associated with the negative social environment of token women. However experiments cannot be used to document whether these phenomena occur at the occupational level, for many workers, in a variety of occupations and outside of the laboratory as can be done with nationally representative survey data. I use these two approaches to exploit the strengths of both methods while also compensating for the weaknesses of each. The intention of pairing these two studies was to answer six related research questions (see page 4).

In Chapter 2 I posit that the sex-composition of occupations is related to the experience of workers and that this experience will be different for men and women. I further develop the theoretical implications of the term “occupational minority” and argue that occupational minority women will perceive relatively low levels of workplace support and that occupational minority men will perceive relatively high levels of workplace support. Thus I hypothesize that the answer to questions one and two will be yes. I then shift focus somewhat and argue that the type of social exclusion reported by women workplace tokens and occupational minorities will cause a biological stress response.

In Chapter 2 I argue that both women and men should exhibit a stress response to being in the minority and experiencing gendered social exclusion. However, though the response does not vary by the sex of the individual, the reason for the response may vary by the sex of the individual. Women should be responsive to minority status and gendered social exclusion because it makes their role as a low-status member of the group especially salient. In contrast, men should be responsive to minority status and gendered social exclusion because it challenges their taken-for-granted role as a high status member of the group. I draw on Status Characteristics Theory (SCT) as well as theories of masculinity to develop this theoretical position (Correll and Ridgeway 2003; Connell 1995). Thus, I hypothesize that the answer to question three is yes and to question three (b) is no. More generally, I argue that high status actors in general, and men in particular, will be more responsive to threats to status when interacting in groups with members who have a lower value on a status characteristic (for example, men in a group of women). Thus I argue that the answer to question three (c) is “high status actors”. Finally I argue that gendered social exclusion and threats to high status actors are both important causes of stress response to tokens under specific conditions (question three (a)).

Figure 1 provides a general overview of the dissertation. The box at the far left depicts the previous research in which this dissertation is most fundamentally grounded. This work has drawn on case studies of firms or industries to establish that women tokens often face negative work environments while token men face positive social environments. My project builds on this work by establishing that sex composition at the occupational level can be associated with similar sex differences in workplace social environments (see center box at top of figure). These findings are described in Chapter 3. The third box at the top of Figure 1 (the box on the top far right) describes the next question I address in this dissertation. Given that we have good evidence that sex composition can be linked to negative workplace social environments for women—what are the consequences of the of those negative social environments? I hypothesize that these environments should cause a stress response—and in particular, a cortisol response. These findings are described in Chapter 4.

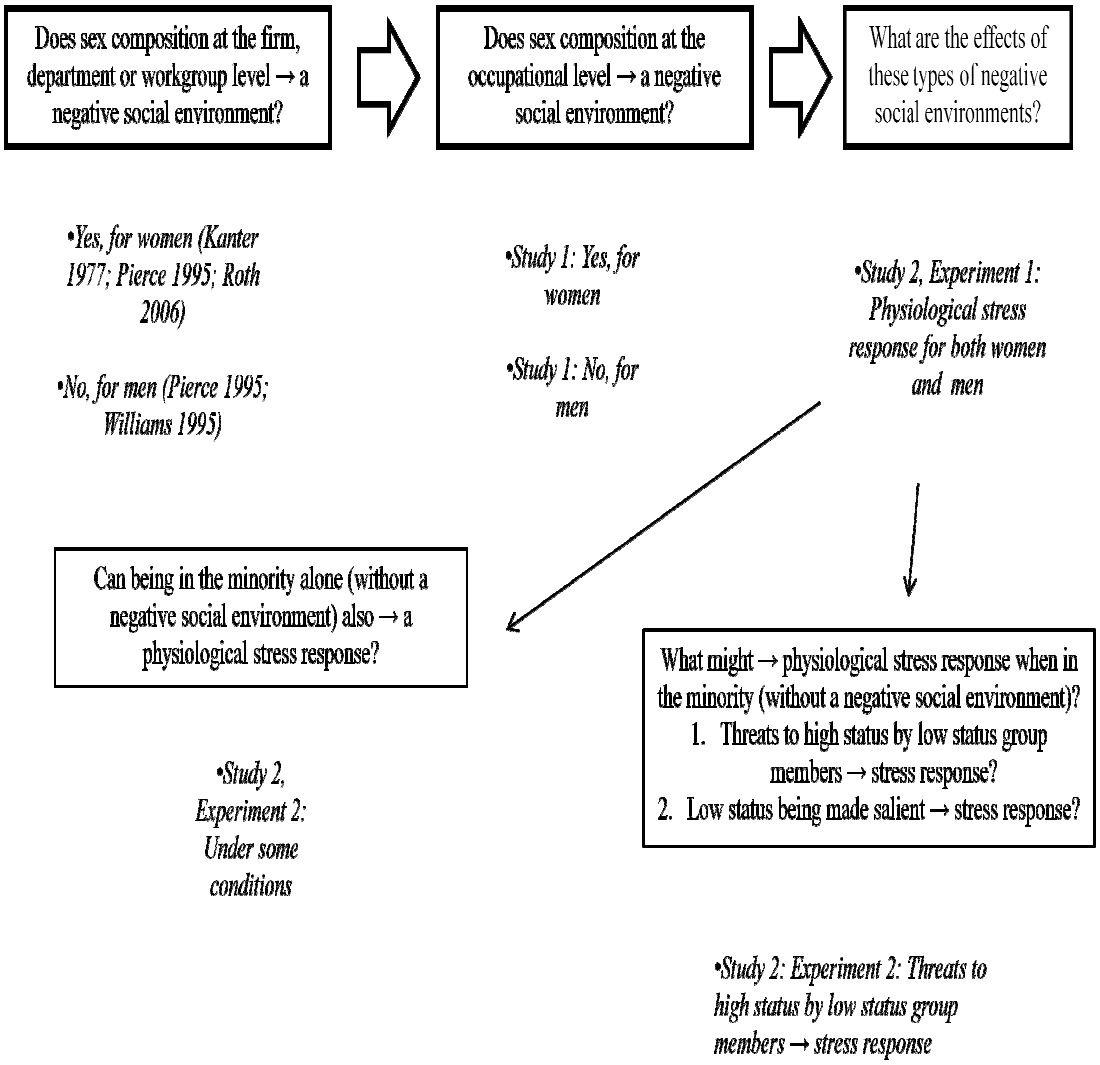

Figure 1: Dissertation Overview

The lower half of the figure addresses two questions that emerge from the findings in the far right box of the top panel. Experiment 2 was developed to address these questions. If the kinds of social environments that token women face can cause a cortisol response among both women and men—what exactly is causing this response?

It is the minority status alone (see the box in the lower left side of the figure)?[6] And if so, what are the status processes that underlie a response to being in the minority (see the box on the lower right side of the figure)? Can these status processes be generalized outside of gendered social environments (see the box on the lower right side of the figure)? The findings related to these final two questions are described in Chapter 5.

[6] The findings from this experiment are described in Chapter 4.

CHAPTER 2

THEORETICAL AND EMPIRICAL BACKGROUND

In the introductory chapter I introduced the main questions informing this project, as well as the methods used to address those questions. I also outlined the theoretical origins of those questions and my main findings. Figure 1 (above) provides a visual representation of these relationships. In Chapter 2 I provide a more complete account of the theoretical work and previous research that informs the dissertation. In the first section of this chapter (*Study 1 – Perceptions of Workplace Support by Occupational Minorities*) I describe the literature that is summarized in the box on the top left of Figure 1 and in the box in the top and center of Figure 1. In the second section of this chapter (*Study 2 — Stress Response to the Token Experience*) I describe the literature that is summarized in the box in the top and left of Figure 1 and in the box on the top right of Figure 1. In addition this second section describes the literature that is summarized in the two boxes on the bottom half of Figure 1.

Study 1 – Perceptions of Workplace Support by Occupational Minorities

The relationship between the sex composition of workplaces and the day-to-day interactional experiences of workers has long been of interest to feminist scholars (Jacobs 1989; Kanter 1977). Kanter's (1977) "Men and Women of the Corporation" was a seminal work in this area in that she took distinctly sociological approach to the question of why women and men reported different experiences when they were working in the same types of jobs or occupations. Other contemporary scholars argued that women and men reported different experiences in the workplace, and especially in management roles, because men and women had inherently different temperaments or

had been socialized to have different types of personalities (Kanter 1977). In contrast, Kanter (1977) convincingly argues that women and men report different experiences in management because they are in a different structural position in the workplace—with women as minorities and men in the majority. Kanter's (1977) work also documented the ways that those in a minority in their workplaces—tokens—are often isolated and offered little support by their coworkers.

One's perception of access to workplace support is an interactional-level phenomenon, and "social-relational" interactions are influenced by cultural understandings of gender (Ridgeway and Correll 2004, 510). In turn, these perceptions are linked to hegemonic cultural beliefs about gender that are made salient by the characteristics of the workers' occupations—especially sex composition. Occupational sex composition can activate gender beliefs and consequently increase or decrease the salience of gender in interaction (Ridgeway and Correll 2004). And this can affect perceptions of workplace support. Previous work has not examined the consequences of sex composition of occupations (rather than workplaces) on gendered patterns of perceptions of workplace support. Perceptions of workplace support are important because they are linked to career mobility, job satisfaction, access to workplace information, and health outcomes (de Jonge et al. 2001; Jacobs 1989; Johnson and Hall 1988; Kanter 1977).

As noted in the introduction, Kanter (1977) defined tokens as women and men in the numerical minority in the workplace. And I draw on Kanter's concept of a "token" to introduce the concept of an *occupational minority*. I argue that a worker's occupation is imbued with meanings about the identity of the worker and the appropriateness of the worker's role in that occupation—and that these meanings can have negative or positive implications for perceptions of interactions and support among workers.

Importance of Perceptions of Workplace Support

Access to work-relevant information and assistance is critical to workplace success, and workers who do not feel that they have access to workplace support experience negative outcomes. Perceptions of low levels of access to workplace support contribute to personal dissatisfaction with work; low retention of women in high-paying, high-status, male-dominated occupations; and blocked organizational mobility for women (de Jonge et al. 2001; Jacobs 1989; Kanter 1977; Pierce 1995). For example, using two waves of data, de Jonge et al. (2001) found that low levels of perceived workplace support at time one were associated with low levels of job satisfaction a year later. In addition, low levels of perceived workplace support are associated with negative physical and mental health outcomes (Blackmore et al. 2007; Johnson and Hall 1988; Loscocco and Spitze 1990). Johnson and Hall (1988), for example, demonstrated an association between co-worker support and prevalence of cardiovascular disease among a large and randomly selected sample of the Swedish population.

Perceptions of access to information and assistance in the workplace also reflect actual levels of access to information and assistance in the workplace. For example, women in the minority in the workplace have less access to workplace support from coworkers and supervisors than white men in the same occupations (Kanter 1977; Pierce 1995; Roth 2006). Actual levels of access to workplace information and support are very important to organizational mobility. Workers who do not have access to workplace information and support have limited access to promotions, raises, and benefits (Kanter 1977; Pierce 1995; Roth 2006). In addition, limited workplace mobility for women in the minority contributes to the glass ceiling.

For example, in a case study of investment bankers on Wall Street (a male-dominated industry) Roth (2006) demonstrates how women are repeatedly thwarted in their career advancement by a lack of support from colleagues and supervisors.

The Relationship between Occupational Sex Composition and Perceptions of Workplace Support

Occupational characteristics, especially the sex composition of occupations, are likely predictors of perceptions of workplace support. To understand this relationship, I draw on scholarship in three main areas: (1) gendered expectations of workplace support, (2) stereotypes about the competence and likeability of women, and (3) workplace social networks. This research demonstrates, among other things, that women experience social backlash when they violate social norms and that stereotypes about women have implications for interactions. These processes become even more pronounced in contexts in which gender is highly salient, such as highly sex-skewed occupations (Ridgeway and Correll 2004). In addition, women are likely to have lower expectations of positive workplace experiences than men.

Gendered Expectations for Workplace Support. Broadly speaking, women have a lower sense of entitlement and lower expectations in the workplace than do men (Graham and Welbourne 1999; Major and Konar 1984). For example, women tend to negotiate less than men, partially because they feel they are not entitled to higher compensation (Babcock and Laschever 2003). Women also report higher levels of job satisfaction than men—even though on average their pay and working conditions are not as good—because they have lower expectations for the quality of their jobs than men (Clark 1997). Similarly, studies that utilize respondents from a broad range of occupations—and do not account for different levels of occupational

sex composition in their models—find that women perceive higher levels of workplace support than men (Roxburgh 1996; Turner and Marino 1994). However, research leads us to expect that whether women perceive higher or lower workplace support will vary with the sex composition of their occupations. Given that women do perceive higher levels of workplace support when occupational sex composition is not taken into account, I predict that women in relatively mixed-sex occupations will perceive higher levels of workplace support than men.[7] This prediction is consistent with the finding that women tend to have lower expectations and a lower sense of entitlement in the workplace more generally. Thus, women should perceive higher levels of workplace support than men, all else being equal. However, all else is not equal when the gender compositions of occupations are highly sex-skewed. In the following sections I argue that in highly sex-skewed occupations women should perceive relatively low levels of workplace support.

Occupational Category as Gendered. Women who are in the minority by sex at the firm level perceive exclusion from workplace support, information, and assistance (Kanter 1977; Pierce 1995; Roth 2006). For example, Kanter (1977) describes how women in the minority at a large firm were deliberately left out of informal meetings of men where important and sensitive workplace information was discussed. She argues that the men did not trust the women in because they were perceived as outsiders by the men.

I investigate whether information about occupational category alone can also establish whether women will experience similar effects—regardless of the sex composition of workers' immediate work environments. Occupational-minority

[7] Mixed-sexed occupations vary on important characteristics including the demography of the workers and whether the jobs are masculinizing, feminizing, or stable (Gatta and Roos 2005). These differences may have an effect on differences in levels of perceived support for women and men; however, addressing differences based on the degree to which occupations are in the process of masculinizing, feminizing, or being stable is beyond the scope of this dissertation.

women should experience the cultural effects of being a woman in a male-dominated field, even if at the firm level their workplace is relatively more mixed or female dominated.

Occupations are meaningful categories, with members sharing tastes, preferences, and experiences (Weeden and Grusky 2005). Using several nationally representative data sets Weeden and Grusky (2005) demonstrated how occupational categories are associated with life-chances and life-styles, political attitudes, and ideologies concerning overwork, among other outcomes. As such, occupational categories are important parts of individuals' understanding of themselves and others.

Occupational categories are also gendered. Occupations are often seen as more appropriate for men than for women (or vice versa), and this is especially salient when workers are in the minority (Kanter 1977). Workers in occupations atypical for their sex are anomalies. Occupational-minority workers may be seen by coworkers and others as violating prescriptive behavioral norms simply by virtue of the fact that they are in nontraditional occupations (Heilman et al. 2004; Pierce 1995). For example, Heilman et al. 2004 used an experimental paradigm to demonstrate that when women are successful in a work position which is seen as male-typed they are more likely than men to be disliked and to be seen as having a difficult personality. Heilman et al. (2004) argue that this dislike arises from a belief that women should not be involved in male-typed activities in the workplace. And workers in male-dominated occupations typically engage in male-typed activities. In sum, I argue that women in occupations that are male dominated at the national level violate social norms because they work in occupations that are gender typed as masculine in the larger culture and are seen as engaging in gender-inappropriate work tasks.

People who do not, or cannot, adhere to gendered ideals of behavior are held accountable and are socially penalized for violating prescriptions of appropriate

behavior (West and Zimmerman 1987). Women in workplace settings who challenge traditional gender stereotypes are especially subject to personal hostility (Heilman et al. 2004; Kanter 1977; Pierce 1995; Rudman and Glick 1999, 2001). For example, Pierce (1995) describes how women litigators are sexually harassed and asked to do menial tasks (such as typing) as a way of demeaning them on the basis of sex and questioning the appropriateness of their placement in a male-typed occupation. Importantly, occupational-minority women are aware that they are violating gendered norms of behavior and expect to be treated differently by people as a result (Pierce 1995; West and Zimmerman 1987). Thus, women occupational minorities may perceive less workplace support because they understand that they will be held socially accountable for violating social norms.

The perception among occupational-minority women that they do not receive support in the workplace and that they do not get information and assistance from supervisors and colleagues also likely arises from the fact that they are actually subjected to social penalties for violating ideals of appropriate behavior for women by working in male-dominated occupations. Research shows that both men and women are likely to see women who violate social norms in the workplace as not likeable—and that coworkers will withhold workplace support due to this dislike (Heilman et al. 2004; Kanter 1977; Pierce 1995; Roth 2006).

In sum, I predict that occupational-minority women will perceive lower levels of workplace support than other workers both because they expect to be treated differently and because they actually are treated differently. In the following section I provide an additional support for why occupational minority women should experience lower levels of workplace support than other workers.

Workplace Integration into Social Networks and Stereotypes about Competence. When workers are not well integrated into workplace networks, they do

not have access to information and assistance. Women and men have differential levels of access to social networks and mentors. In general, women are disadvantaged by these differences and have less access to opportunity, influence, and information in the workplace (Brass 1985; Ibarra 1992; Pierce 1995; Smith-Lovin and McPherson 1993). Occupational-minority women are especially disadvantaged. Women who are occupational minorities are relatively less integrated into workplace social networks because of negative stereotypes about the status and competence of women in nontraditional occupations paired with workers' preferences for affiliation with high-status others.

Workers prefer affiliation with high-status or especially competent others, and occupational-minority women are stereotyped as less competent and seen as lower status than men coworkers. Occupational-minority women face doubts from their coworkers about their competence because day-to-day work tasks in male-dominated occupations are typically gender typed as the kinds of tasks at which men are more competent (Ridgeway 1997; see Britton 2000 for a more in-depth discussion of this issue). Thus, stereotypes that women in male-dominated occupations have relatively low levels of competence help to explain why occupational-minority women encounter low levels of support in the workplace.

SCT offers particular insight by demonstrating that there are widely held cultural beliefs that men are more status worthy, influential and competent than women (Correll and Ridgeway 2003). That is, ceteris paribus, men are seen as higher status and more competent in the workplace than women (Correll and Ridgeway 2003). Occupational-minority women are especially disadvantaged in their access to workplace support because this belief is stronger in situations in which gender is especially salient, such as in male-dominated occupations. To the degree that workers prefer to form networks with high-status others, occupational-minority women will

have fewer opportunities to create networks based on biased beliefs about their lower levels of competence and status.

In addition, network ties of all kinds are more often established among people who have similar personal characteristics (McPherson, Smith-Lovin and Cook 2001). Even though women occupational minorities do not necessarily work in environments in which they are in the minority by sex (for example, the woman surgeon discussed above), they are likely to move between environments with varying sex compositions. And these women will often encounter a majority of opposite-sex colleagues at times that are especially important to occupational mobility and networking—for example, sales and business trips and conferences (Kanter 1977; Pierce 1995). In addition, even if the majority of their day-to-day coworkers are women, it is likely that their supervisors are men. For example, a woman surgeon who works with mostly other women surgeons and nurses is likely supervised by a chief of surgery who is a man. Her ability to gain workplace support from affiliation with a supervisor who is a man will be compromised to the degree that he demonstrates an in-group preference for affiliation with subordinates who are men. In summary, occupational-minority women have compromised access to network connections because of stereotypes about the competence and status of women in male-dominated occupations and preferences for afflation with high-status and similar others. Occupational-minority women are likely to perceive that they are receiving relatively low levels of help, support, information and listening from coworkers and supervisors due to this compromised access to network connections.

Occupational-Minority Men. In general, violating gender norms by working in a female-dominated occupation does not result in the same social sanctions of white

men[8] in the workplace that women occupational minorities experience (Pierce 1995). For example, to the degree that coworkers and supervisors are uncomfortable with white men's violations of gender norms, they will tend to be pushed higher into organizational ranks and into leadership positions that are seen as appropriate for men (Williams 1995). Hence, white men who are occupational minorities are likely to perceive relatively high levels of workplace support.

In addition, white occupational-minority men do not experience the problems with isolation from workplace networks experienced by occupational-minority women. First, white occupational-minority men are likely to have the characteristic of sex in common with supervisors (Pierce 1995; Williams 1995)—and white men are also likely to share the characteristic of race. Thus, to the degree that supervisors prefer to affiliate with in-group others, white occupational-minority men are likely to have relatively high levels of access to supervisors and consequently relatively high levels of perception of workplace support. Second, white occupational-minority men are typically welcomed by women coworkers, perhaps because they are seen as bringing status to female-dominated occupations (Correll and Ridgeway 2003; Gatta and Roos 2005; Pierce 1995; Williams 1995).

Summary and Theoretical Predictions

[8] Recent work by Wingfield (2009) provides evidence that this process is racialized – African-American men who are occupational minorities typically do not receive the same benefits and social status as their coworkers who are white men. These men are often not treated well by supervisors, colleagues and clients in social interactions. The intersection of ethnicity and gender in the workplace is an important issue with implications for the work I describe here. However, I do not address the intersectionality of ethnicity and gender in this dissertation. Rather, I draw on work on both token and occupational-minority men that primarily addresses the experiences of men who are not minorities on the dimension of ethnicity (Pierce 1995; Williams 1995). That is, the work reviewed above applies primarily to men who are white. In contrast token and occupational-minority women who are white and also women *and* men who are part of an ethnic or racial minority both report negative workplace experiences (Pierce 1995; Wingfield 2009). For this reason I use the terms "white occupational minority men" and "white token men" in order to indicate that this positive social experience is largely specific to the ethnic/racial group of white men.

I predict that in relatively mixed-sex occupations, women will perceive higher levels of workplace support than men perceive. Drawing on work on sex differences in job satisfaction and pay satisfaction, I suggest that this may be based on women's low levels of feelings of entitlement (Babcock and Laschever 2003; Clark 1997; Graham and Welbourne 1999; Major and Konar 1984). In sex-skewed occupations, this default explanation of women's low level of entitlement is overcome by the relatively hostile environment for occupational-minority women as well as the relatively welcoming environment for white occupational-minority men. I predict white occupational-minority men will perceive higher levels of access to workplace information and assistance than occupational-minority women. As such, the relationship between worker sex and workplace support across the full range of sex compositions of occupations (0 to 100 percent women) is not straightforward. I expect a curvilinear relationship between the sex composition of an occupation and perceived workplace support.

This curvilinear relationship will be different for men than for women. Men should perceive relatively high levels of work support in occupations with a high percentage of women and relatively low levels of work support in occupations more evenly split between women and men. In contrast, women should perceive relatively low levels of work support in occupations with a high percentage of men and relatively high levels of work support in occupations more evenly split between women and men.

Study 2 — Stress Response to the Token Experience

In the theory developed above I draw on Kanter's (1977) definition of token to

introduce the concept of an occupational-minority. And, I theorize that women who are occupational-minorities will perceive low levels of support in the workplace. In this section I return to the concept of token as originally conceptualized by Kanter (1977) and others who built off her work (for example, Pierce 1995).

I use the evidence reported in ethnographic and interview studies on tokens to make the theoretical claim that the social experiences of token women in the workplace could result in a measurable, physiological stress response (see box in top right of Figure 1). Specifically, I make the argument that these experiences can cause a cortisol response. And I argue that if men were exposed to the same negative social environments to which token women are exposed, they would evidence a similar cortisol response. I draw on ethnographic and interview studies which document that token women have negative social experiences in the workplace as well as work that deconstructs essentialist explanations for sex differences between women and men (Epstein 1988; Kanter 1977; Pierce 1995; Roth 2006). I also specify the conditions under which high status tokens (men) are especially responsive to threats to status from low status majority group members (women) (see box in bottom right of Figure 1). I argue that this will occur most strongly under conditions of social ambiguity.

The Social Environment of Token Women in the Workplace

The research on token women describes various gendered phenomena that occur in the workplace. These include doubts about the competence of women engaged in male-typed tasks, personal hostility towards women who demonstrate competence in male-typed tasks, social exclusion of women who violate gender norms, heightened performance pressures on women and blocked access to promotion, high-status mentors, and important workplace social networks (Burgess and Borgida

1999; Glick and Fiske 2001; Heilman et al. 2004; Kanter 1977; Pierce 1995; Rudman and Glick 1999). For example, research has demonstrated that token women often encounter "boundary heightening" in the workplace (Kanter 1977: 221; Pierce 1995). Boundary heightening occurs when dominant group members (in this case, men) make stereotypical ideas about group differences (in this case, sex differences) salient through social interactions. These interactions may include an exaggeration of the differences between the dominant group and the minority group, sexual harassment and informal social exclusion of minority group members in the workplace. In the case of token women, the boundary to be made salient is sex—that is, the "boundary" between the minority and majority group in male-dominated occupations. In interview and ethnographic studies, token women report that phenomena such as boundary heightening can create a difficult and stressful work environment (Kanter 1977; Pierce 1995; Roth 2006). Women in male-dominated occupations often feel subtly excluded from informal social interactions and boundary heightening can be the cause of these feeling of exclusion.

Gendered Social Exclusion. In this dissertation I use the term "gendered social exclusion" to describe social experiences along the lines of boundary heightening that occur for token women. I use "gendered social exclusion" instead of "boundary heightening" because I focus specifically on the gendered nature of the type of social exclusion experienced by token women. The term boundary heightening (as conceived of by Kanter) is too broad for my purposes because boundary heightening can refer to social exclusion along any dimension (race, age, nationality, etc) by the dominant group towards the minority group. The broad meaning of boundary heightening is a powerful concept and does occur across many groups. For example, negative social interactions arising out of racism could be thought of as boundary heightening (Feagin 1991). However, in this project I am interested in documenting the experience of

boundary heightening on the dimension of sex alone. Accordingly, I use the term "gendered social exclusion" to describe the social experiences of token women who are socially excluded by men while men make perceived social boundaries between women and men salient.

In this study I focus on the phenomenon of gendered social exclusion for two reasons. First it is an important mechanism for the blocked advancement and discomfort reported by token women in the workplace. And second it should be sufficient (when combined with minority status by sex in a group) to cause a physiological stress response.

The mechanism of gendered social exclusion is important because informal social exclusion has negative consequences for token women. Pierce (1995) describes how women litigators (a male-dominated occupation) feel that they have trouble advancing professionally because they are being excluded from socializing with men in their law firm and how this exclusion has a gendered tone. Pierce (1995: 107) quotes one of the women litigators as saying:

> My supervisor is so disengaged [from me]. But there is an underlying unspoken camaraderie between him and the male associates. There is just no way for me to crack through it. They play golf together…I'm never included.

Pierce (1995) also describes a case in which she (as a participant-researcher working as a paralegal in the law firm) tries to make conversation with group of men. She is repeatedly shut out of the conversation by one of the men who first says, "Jennifer's here. I guess we'll have to swap recipes or something" (Pierce 1995: 147). He

subsequently rebuffs her effort to change the conversation topic to movies by saying "…I bet you only like love stories" (Pierce 1995: 147). Then men finally turn to simply ignoring her when she counters that she is partial to "thrillers" (Pierce 1995: 147). In cases like these, women tokens find it difficult to engage in male-typed social activities and conversations with co-workers and supervisors who are men.

Exclusion is problematic for female litigators—and for women in male-dominated occupations more generally—because when women are excluded from socializing with men in male-dominated occupations they are being excluded from fitting in with what is considered a higher status group (that is, men) that typically has more access to power and prestige in the workplace (Brass 1985; Pierce 1995). In addition, gendered social exclusion can cause token women to feel highly visible as tokens—their status as a minority is being made salient through a focus on their sex in social interactions with majority group members (men) (Kanter 1977). Gendered social exclusion can also create a feeling that success in informal workplace interactions (especially with high status men who have access to power, prestige and workplace mobility) is out of their control (Kanter 1977; Pierce 1995). For these reasons exposure to gendered social exclusion may block token women's advancement in the workplace and should cause discomfort or a stress response among token women.

Status. SCT gives us further insight into the experiences of token women in the workplace. As described above, decades of research in the SCT tradition has documented that individuals possess socially significant characteristics (such as age, race, gender or occupation) that are culturally associated with differing levels of competence and social worthiness—that is, social status. One important characteristic is gender and there are widely held cultural beliefs that men are generally more

competent and status worthy than women (Correll and Ridgeway 2003). Specifically, SCT makes the empirically supported prediction that in goal-oriented groups men will have more influence and be considered higher on the social hierarchy than women (Correll and Ridgeway 2003). Furthermore, these beliefs can be made more or less salient depending on the situation.

In making my predictions about stress response I draw on SCT and its empirically supported propositions about the status differences between men and women in goal-oriented groups. Token women should exhibit a stress response to being a low-status member of a male-dominated group when the status characteristic of gender is made especially salient through gendered social exclusion. In the next sections of this chapter I outline why cortisol is especially likely to be activated under the conditions which token women face.

Social Processes and Cortisol Activation

Research demonstrates that humans are fundamentally social creatures and that social environments affect us on both psychological and physiological levels (Baumeister and Leary 1995; Cacioppo and Berntson 2006; Norris et al. 2004). In particular, social exclusion—rejection from social groups or relationships—can be a stressor. While previous research on social exclusion has not drawn a specific connection between social exclusion of tokens in the workplace and stress response, I draw on this previous research to make this connection. I hypothesize that gendered social exclusion experienced by token women is likely to be a stressor. I attempt to better understand the relationship between the experiences of token women and physiological stress response by drawing on empirical literature which demonstrates

that biological and social factors are linked and that these factors impact each other (Dickerson and Kemeny 2004; Eisenegger et al 2010; Eisenberger, Lieberman and Williams 2003; Sapolsky 2000; Wraga et al 2006). Specifically I measure cortisol, a hormone that is elicited in humans by exposure to specific types of social stressors.

When people are faced with threats they demonstrate physiological responses. These responses include activation of the hypothalamic-pituitary-adrenal (HPA) cortical axis (Huebner and Davis 2005). Cortisol increase is associated with activation of the hypothalamic-pituitary-adrenocortical (HPA) system (Dickerson and Kemeny 2004). Dickerson and Kemeny (2004: 357) describe this system as a "social self-preservation system," a system that "monitors the environment for threats to one's social esteem or social status and [that] coordinates psychological, physiological, and behavioral responses to cope with such threats."

Perception of threat is an important component of whether an elevation of cortisol levels will occur (McEwen 1998). In this sense the activation of cortisol is a social phenomenon—an individual's perception of a social threat is central to cortisol response. And this perception is necessarily based on the social structures and interactions which influence the meaning and narrative that individuals make of their social environments. Sociological research provides many descriptions of the kinds of environments which could feel socially threatening. For example many middle class African-Americans are treated as unwelcome in public places such as high-end restaurants and stores (Feagin 1991). This type of treatment could certainly be seen as a threat to status or social esteem and African-American's who are subjected to this treatment report high levels of stress and negative affect (Feagin 1991).

Sociologists provide many other examples of social groups who report stress or negative affect that comes from perceiving a social threat based on characteristics such as race, sexuality, class, etc. (for example, Aries and Seider 2005; Hamilton 2007). It

is likely that these types of social stressors cause a stress response at the individual level. In particular, these social stressors may cause a cortisol response. However sociologists have not attempted to measure individuals' psychological stress responses to negative social environments. In this study I make such an attempt and argue that the negative social environment encountered by token women should cause a cortisol response. In the following section I explain why it is important to understand potential cortisol response among token women as well as other minority groups.

The Importance of Cortisol Response: Health and Social Inequality

Health. Research has established links between social isolation[9], stress response, and negative health outcomes. That is, there is a connection between negative health outcomes and social isolation – with higher levels of social isolation being associated with more negative health outcomes (Baumeister and Leary 1995; Cacioppo and Hawkley 2003; Cohen et al. 1997; Cornwell and Waite 2009; House, Landis, and Umberson 1988). In addition, an important mechanism linking social isolation and negative health outcomes is stress exposure and/or perceived stress. For example, when stress response is sustained over time (especially chronic stress related to interpersonal problems and chronic stress related to workplace difficulties) it has a negative impact on health status over time (Cohen et al. 1998; Robles and Kiecolt-Glaser 2003; Umberson et al. 2006).

Due to the links between health, stressors and social isolation it is important to examine the potential effects of social exclusion in the workplace—which can cause social isolation—on token women. Adults who work full-time spend most of their day

[9] Social isolation is a more broad term than social exclusion. Social isolation can be the result of social exclusion or can be self-imposed.

in the workplace and therefore, if social exclusion in the workplace is a stressor, this stressor can be chronic due to the nearly constant exposure to this environment. I expect an increase in cortisol among token women in the workplace due to minority status and gendered social exclusion.

Cortisol increase is related to negative health outcomes because increased levels of cortisol released in the body are a sign of activation of the HPA system and prolonged activation of the HPA system is related to a variety of negative health outcomes (Cohen, Kessler and Gordon 1995; Dickerson and Kemeny 2004; Kudielka and Kirschbaum 2005; McEwen 2004; Miller, Chen and Zhou 2007). The workplace experiences of token women may increase the likelihood of chronic exposes to cortisol response and thus increase the likelihood of negative health outcomes for token women. It is therefore important to document the relationship between token status, gendered social exclusion and cortisol response.

In addition, a relationship between minority status and negative social environments may have health implications for other minority groups. For example, chronic exposure to racism is likely a factor related to negative health outcomes among African-Americans. A better understanding of the specific processes of how exposure to racism may be connected to negative health outcomes—through activation of cortisol response, for example—would be very useful in developing health policy to ameliorate these processes.

Social Inequality. These experiments are also designed to advance knowledge of the relationship between stress response, status and social inequality. I developed a novel paradigm which measures cortisol response in an experimental setting. I use this paradigm to attempt to replicate the experience of being a token woman—a situation that research on status processes and gender in the workplace indicates should activate cortisol. That is, I use the experimental approach to create a setting in which a person

might be socially excluded because he or she is in the minority in a group—and might be especially responsive to that exclusion because of social and status processes. This attempt to recreate, in a laboratory setting, the negative social processes that are commonly faced by minorities is a new approach to measuring cortisol response in the laboratory (Dickerson and Kemeny 2004; Kanter 1977; Nicolson 2008). Though an examination of both the literature on women in male-dominated occupations and the literature on cortisol response indicates that the negative social environments encountered by token women should produce a cortisol change, no other study has tried to establish such a relationship. A demonstration of the relationship between cortisol response, minority status by sex and gendered social exclusion will contribute to sociological knowledge of how status processes can impact physiological stress responses among minorities.[10]

New information about cortisol response to being in a position of low status, when in the minority, can inform the literature on social inequality more broadly. Given that cortisol is activated in situations in which social status, social performance and social exclusion are very salient, many situations in which minority status based on status characteristics is important to social actors (such as workplace or educational settings) are likely to provoke a cortisol response (Dickerson and Kemeny 2004; Feagin 1991; Steele and Aronson 1995). Thus my research on the relationship between gender, token status, cortisol reactivity and stress may provide a beginning point for examining the relationship between socially relevant characteristics of many kinds (for example race, ethnicity, nationality or sexual orientation), cortisol reactivity and stress response in social environments.

[10] In addition this work contributes to the literature on cortisol response. There have been few attempts in laboratory settings that both replicate processes of interest to specific populations in a specific social setting and also elicit cortisol response, as I do in the experiments described in this dissertation (Nicolson 2008).

The Experience of Token Women and Cortisol Activation

Token women are commonly exposed to social structures and interactions that are likely to cause chronic cortisol response. More specifically, cortisol changes have been associated with five types of stressors that are relevant to the experiences of token women: (1) social exclusion or rejection from group members, (2) threat to status or place in a hierarchy in a group, (3) social evaluation of valued attributes or skills, (4) social evaluation of a goal directed performance, and (5) tasks in which the outcome of the performance is uncontrollable (Dickerson and Kemeny 2004). In sum, cortisol should be activated by these five phenomena and research on women in male-dominated occupations has documented that token women often experience these phenomena. First, case studies have documented that co-workers socially exclude token women and social exclusion is known to increase cortisol response (Kanter 1977; Pierce 1995). Second, in male-dominated occupations the status dimension of gender is often particularly salient, with women being seen as a lower status group than men. Cortisol change may occur when membership in a low-status group is made salient by the sex composition of the group alone, through gendered social exclusion, or both. Third, research on token women provides good evidence that these women are subject to higher than normal levels of social evaluation, in part because they are highly visible due to their minority status (Kanter 1977; Pierce 1995). Gendered social exclusion also makes token women feel especially visible because their minority status is being made even more salient. High visibility increases performance pressures on token women in the workplace and may increase cortisol levels. Fourth, goal oriented situations increase the likelihood of cortisol activation and workplace situations are primarily goal oriented. Fifth, token women may see the evaluation or outcome of

tasks as uncontrollable because they are faced with co-worker's doubts that they will perform competently at male-typed tasks (Heilman et al 2004). Furthermore, when women *do* perform well at male-typed tasks they are often socially sanctioned for violating gender norms and viewed negatively on an interpersonal level (Heilman et al 2004). Because doing well at the task is not likely to decrease negative social evaluation, token women are likely to feel that a negative evaluation of them is out of their control. This lack of control over the evaluation of one's performance is another component of social situations that may elevate cortisol levels. In sum, women in the minority by sex and subjected to gendered social exclusion in the workplace face five types of social stressors thought to elicit cortisol change. I expect then that token women should experience cortisol activation in the workplace. In addition I expect that token women will exhibit a cortisol response when working with a task-oriented group in a laboratory setting—when they are in the minority by sex and exposed to gendered social exclusion.

I demonstrate above that token women have negative social experiences in the workplace that likely impact career trajectories and outcomes, by drawing on research based on the self-reports of token women. In addition I make the case for the ways in which the negative experiences of token women can cause cortisol response. In sum, I argue that token women should experience a cortisol response to their social environments in the workplace.

However, white[11] token men are not exposed to the same negative workplace social environment as token women (Pierce 1995; Williams 1995). In contrast to token women, white token men report high levels of social inclusion from colleagues and supervisors (Williams 1995). For this reason I do not expect that white token men are

[11] See footnote 8 for a more in-depth discussion of the intersection of race and ethnicity with token status.

likely to experience especially high stress response in the workplace. However, it is to interesting investigate whether token men will evidence a similar cortisol response to token women when exposed to identical social conditions in a laboratory setting. If women and men evidence similar cortisol response to being in a similar laboratory setting, this provides further evidence for work which argues that observed differences between women and men are based more on gendered social conditions than on physiological differences between the sexes (Epstein 1988). In addition a better understanding of the sex similarities, or differences, in response to controlled social conditions in a laboratory setting can offer insight on the gendered cultural processes that contribute to perceived differences between men and women.

Status Processes and Sex Differences in Cortisol Response to the Experience of being a Token in the Workplace

In previous sections I began to develop theoretical and empirical background concerning token women's and men's stress response in the workplace and in the laboratory. In the next sections, I detail and justify specific theoretical predictions concerning in cortisol response in two laboratory experiments (see the box on the top, right side of the Figure 1, as well as the two boxes in the lower half of the figure). In the first of these experiments I expose both men and women to the social environment faced by token women in the workplace (that is, being a minority on the dimension of sex and experiencing gendered social exclusion). Thus, this laboratory experiment creates a negative social environment that does *not* occur widely for white token men in actual workplaces. In the second experiment I expose women and men to the experience of being in the minority on the dimension of sex, but not to being exposed to gendered social inclusion. In these experiments I am attempting to determine if

women or men have different physiological responses when they are exposed to the *same* social conditions.

In the following sections I first review the research on sex differences in cortisol response in a laboratory setting. Second, I draw on empirical and theoretical work in the field of sociology to make predictions about the cortisol response of token men and women in the experiments described in this dissertation. I argue that when exposed to the social conditions experienced by token women in the workplace, men and women should demonstrate a similar physiological response. But I also assert that the pathways to this response may differ in gendered ways. I draw on SCT and sociological work in the area of masculinities to understand the different ways in which men and women may respond to the experimental scenarios.

Psychological Research on Sex Differences in Cortisol Responsiveness in a Laboratory Setting. Findings from psychological[12] research on sex differences in cortisol response to stressors in a laboratory setting is somewhat mixed. In addition, this research does not shed much light on the specific question of whether women and men will exhibit different levels of cortisol response when exposed to the social conditions of: (1) being in the minority by sex and (2) being subjected to gendered social exclusion. Previous psychological studies have not attempted to address these two questions.[13]

[12] I draw exclusively on psychological research on sex differences in cortisol response in a laboratory setting in this section because, to my knowledge, there is no such research in the field of sociology.

[13] One study does indicate that women may have higher cortisol response to social exclusion than men (Stroud et al 2002). However the results of this study are not conclusive. The findings include high standard errors, small increases in cortisol, depend on a small sample size and these findings have not been replicated (Kajantie and Phillips 2005; Kudielka and Kirschbaum 2005). Also, Stroud et al (2002) only examine social exclusion in same-sex groups, in groups that are not goal oriented and do not expose participants to *gendered* social exclusion. In contrast, the experiments described in this dissertation compare cortisol response to exclusion in same-sex groups to cortisol response to exclusion in opposite-sex groups. In addition my experiments combine social exclusion with other achievement tasks with the intention of creating a laboratory scenario that mirrors real-life workplace interactions.

Most studies indicate that there are no differences in cortisol response by sex to a variety of laboratory stressors or that cortisol response among men is slightly higher than among women. For example, one meta-analysis of 208 laboratory studies of psychological stressors found no significant difference (at $p > .20$) between men and women's cortisol response (Dickerson and Kemeny 2004). However, two review articles report that men have moderately higher cortisol response than women to a variety of psychological stressors induced in a laboratory setting (Kajantie and Phillips 2006; Kudielka and Kirschbaum 2005). This moderate difference varies by phase of menstrual cycle, menopausal status and pregnancy. In general, between puberty and menopause adult women's cortisol is somewhat less responsive to psychological stressors in the laboratory than adult men's cortisol response. In sum, though men are slightly more responsive than women in some cases, sex differences in cortisol response to laboratory stressors are neither stable nor consistent across studies (Nicolson 2008).

The area of understanding sex differences in cortisol response is an important one in which there has not been a large variety of psychological stress tests consistently applied. Researchers in this area have encouraged further work with different kinds of tasks that might help to better understand differences in cortisol response between men and women (Kudielka and Kirschbaum 2005). The experiments described in this study can help to elucidate how women and men respond in a situation that contains elements of scenarios that have triggered cortisol response in both women and men in previous studies. In addition, by bringing a sociological approach to this work I make novel predictions concerning the cortisol response of men and women. Specifically, I focus more on the cultural meanings of gender that might evoke sex differences in cortisol response—rather than essentialist explanations for sex differences in cortisol response.

In the following sections I take a sociological approach to make predictions about the cortisol response of men and women tokens. I draw on work in the sociology of gender (especially in the area of masculinities) as well as theoretical work from sociological social psychologists (for example, SCT). I first detail the different social experiences of men and women in the workplace and how these different experiences might lead to differential stress response. Then I argue that when exposed to identical social conditions in the laboratory women and men should evidence similar levels of stress response. Finally, I specify the conditions under which token women and men may not have the same stress response to similar laboratory conditions.

The Different Social Experiences of Women and Men Tokens. Interview and ethnographic research finds that the effects of being a token in the workplace are different for men and for women; white token men encounter positive work environments and token women encounter negative work environments (Pierce 1995; Williams 1995). Specifically, research and theory are consistent with the idea that token women experience higher levels of social exclusion in the workplace than white token men. Furthermore, white token men report that they benefit from being tokens in the workplace in terms of promotion and pay while token women do not (Kanter 1977; Pierce 1995; Williams 1995).

There are several reasons that white token men are less likely to be socially excluded and more likely to be advantaged in terms of pay and promotion in the workplace than token women. First, the entry of men and women into an occupation has different status implications for that occupation. Other things being equal white men are seen as higher status and more competent at important skills than women, by both women and men (Correll and Ridgeway 2003). White men bring this higher status with them into female-dominated workgroups. Not only do women in the workgroup see white men as higher status than other women in the workgroup but

they also see men as bringing status to the group as a whole. Conversely, an increase in the proportion of women in an occupation is often associated with a loss of pay, status and prestige for that occupation (Reskin and Roos 1990). This potential loss may cause men in that occupation to feel uncomfortable with women in the occupation, or to even intentionally make women feel uncomfortable so as to discourage entry of other women into the occupation. On the other hand, white men's entry into female-dominated occupations typically raises the pay and prestige of those occupations and generally women in female-dominated occupations are welcoming of men into their workplaces (Williams 1995). Second, even if white token men are socially excluded in female-dominated occupations, this exclusion seems to be less threatening to them; after all, they are being excluded from participating in a low-status activity (that is, socializing with women in a low-status job). For example Pierce (1995) describes how paralegals (a female-dominated occupation) who are men typically chose not to socialize with paralegals who are women, at least partially because they want to downplay their association with the feminine (and thus, low-status) nature of their job.

Exposing Men and Women to Identical Social Treatment in a Laboratory Setting. I argue above that the negative social environments that token women are exposed to could cause a stress response—specifically, a cortisol response. In addition I review literature that demonstrates that white token men do not report being exposed to these negative social conditions. But what happens when men and women are exposed to the *same* negative social conditions? I argue above that women should exhibit a cortisol response to being in the minority by sex and being subjected to gendered social exclusion. If this is the case, will men also exhibit a cortisol response to being in the minority by sex and being subjected to gendered social exclusion? Or, do men and women have different cortisol responses to being subjected to the

conditions of gendered social exclusion and minority status?

The question of whether women and men participants will have different levels of cortisol response when exposed to identical social conditions is linked to the larger question of whether women and men generally exhibit different physiological responses to similar social situations. The idea that men and women exhibit predictable and meaningfully different biological responses to socially identical situations underlies common explanations for sex differences. For example, many people would assert that more domestic violence is perpetrated by men than by women because testosterone makes men innately more aggressive than women. Such biological explanations for perceived sex differences in behaviors and preferences are quite common and routinely emerge in folk wisdom, the popular press (for example, Kolhatkar 2010) and in academic work (for example, Baron-Cohen 2003) (Risman 1998). This theoretical position that biological sex differences can explain many of the perceived differences between men and women is known as essentialism. Risman (1998) defines essentialism as "the assumption that basic differences in orientation and personality between men and women are rooted in biology and nature" (Risman 1998, 2). However this assumption that observed sex differences in behavior are caused by underlying biological sex differences has been widely critiqued by scholars in the sociology of gender as well as by other physical and social scientists (Epstein 1988; Risman 1998; Sapolsky 2000).

An important critique of essentialist explanations for sex differences in behavior is Epstein's (1988) concept of "deceptive distinctions". She uses the term deceptive distinctions to highlight the way in which observed "distinctions" between women and men can be "deceptive". She argues that women and men behave differently (or, seem to behave differently) not because women and men react differently to the same social conditions, but rather because women and men

systematically face different social conditions. Epstein (1988) argues that "the impact of social structure on the behaviors and attitudes of men and women results in most of the perceived differences between them" (100).

Critiques of essentialist explanations for sex differences are important because essentialist explanations are often used to legitimate and explain gender inequality (Risman 1998). For example, the answer to the question of whether men and women have innately different preferences and behaviors is important because an affirmative answer to this question underlies essentialist explanations for occupational segregation by sex. A common explanation for the high level of occupational segregation by sex in the United States is that is that women and men are different such that men have more of an aptitude, or a preference, for specific occupations (typically higher status and higher paid occupations) than women (Epstein 1988; Glass 1990; Kolhatkar 2010; Rhode 1997). For example the dearth of women in investment banking is often attributed to an innate aversion to competition and aggression among women. These types of explanations for observed occupational sex-segregation rely on a specific assumption: that men and women are different in important and fixed ways that explain perceived sex differences in social behavior. In contrast, a large body of work in the area of the sociology of gender provides theoretical and empirical support for the idea that occupational segregation by sex can be explained by gendered social structures and interactions (Acker 1990; Cha 2010; Epstein 1988; Kanter 1977; Pierce 1995; Risman 1998; Williams 1995).

In the experiments described in this dissertation I build off of this work in the sociology of gender. I create a social situation in an experimental laboratory that mimics a social situation experienced by token women—but not by white token men—outside of the laboratory. I use the experimental method to subject both men and women to this social situation in the laboratory. That is, both women and men will

be exposed to gendered social exclusion when they are in the minority by sex in a work group. This is an important methodological advancement because, as Epstein (1988) and Risman (1998) point out, women and men systematically encounter different types of interactional pressures and are systematically found in different social-structural locations outside of the laboratory setting (in the "real world").

The laboratory setting then provides a unique opportunity to place men and women in similar structural and interactional conditions and determine whether they have a similar biological response to those conditions. That is, I subject both women and men to being in the minority by sex in a work group in the laboratory (a structural condition) and to encountering gendered social exclusion from other work group members (an interactional condition). Based on the work reviewed above I expect that both women and men will exhibit a cortisol response to being in the minority by sex and being subjected to gendered social exclusion while working in a task-oriented group in a laboratory setting.

Masculinity and Gendered Status Processes. Despite the arguments (along the lines of "deceptive distinctions") made above, there is also theoretical and empirical work in the sociology of gender that indicates women and men do not always experience the same social conditions in the same way (Connell 1995; West and Zimmerman 1987; Willer In Preparation). However, this work provides evidence that these differences are not based on biological sex differences, but rather that they are based on culturally differing meanings of masculinity and femininity.

The case of the differential cultural meanings of masculinity and femininity—and their different relationships to the meanings of status—is especially relevant to the social stress responses of people in the minority by sex in a task-oriented work group. For this reason, I draw on theoretical and empirical work on the concept of masculinity threat which provides evidence that men are very responsive to threats to

masculinity and women are not responsive to threats to femininity (Connell 1995; Willer In Preparation). For example, in a laboratory experiment men exposed to threats to masculinity were likely to "overcompensate" by exhibiting a variety of exaggerated masculine-typed behaviors and attitudes (Willer In Preparation, 1). In contrast, women exposed to an analogous threat to femininity did not show any evidence of trying to restore their threatened femininity. Willer (In Preparation) and others (for example, Connell 1995; Kimmel 1994) argue that this type of response to threatened masculinity is common because masculinity is highly confounded with social status. Therefore a threat to masculinity, for men, is also threat to social status. A loss of femininity for women, on the other hand, is not associated with a loss of status. In fact, in women often gain status by being seen as more masculine and less feminine.[14] Thus, similar social experiences may impact women and men differently depending on the gendered cultural meanings of their social experiences. This is especially true in the case of the confounded cultural understandings of masculinity and status.

In order to better understand the relationship between masculinity and status in task-oriented work groups, I again draw on SCT. Research on SCT demonstrates that there are stereotypic beliefs in the culture associating some groups with more status, social worthiness, and competence compared with other groups (Correll and Ridgeway 2003). For example, all else being equal men are afforded higher status than women. In the context of SCT, "status" means that men or whites are expected to offer more valuable contributions to a group, to have more influence over others (Wagner, Ford and Ford 1986) and to have their contributions evaluated more positively (Berger et al. 1977; Berger & Webster 2006; Foschi 1996). In the case of gender, both men and

[14] This status gain often comes with social penalties however. Women who are perceived as unusually masculine often face social backlash (as described earlier in this chapter).

women are more likely to be influenced by task suggestions offered by a male group-mate (Wagner, Ford and Ford 1986). Importantly, both women and men are aware that men are generally socially evaluated as higher status and more competent than women (Correll and Ridgeway 2003). Drawing on this work, the following paragraphs detail more explicitly the conditions under which I expect token men and women to exhibit a cortisol response.

Based on SCT, I argue that men working in a group of women will take for granted that the women will treat them as a relatively high status group member. That is, men will expect to have more influence in the group, have more opportunities to participate, to have their contributions evaluated positively, etc. And theory and research in the area of masculinities demonstrates that men are especially sensitive to threats to status and power (Connell 1995; Kimmel 1994). Therefore, men may exhibit a cortisol response when there is a perceived threat to their taken-for-granted higher status. Working in a group comprising members with a lower value on the status characteristic of gender (women) is a situation where being treated as low status would be especially problematic and threatening to a taken-for-granted high level of status. Gendered social exclusion of a man by a group of women could be seen as such a threat. I predict then, that men will exhibit a cortisol response when they are in a group of women who are subjecting them to gendered social exclusion.

Similarly I expect that expect that token women will exhibit a cortisol response to being in a group of men in which they are socially excluded in a gendered manner. These women will be a low-status member of a male-dominated group in which their lower value on the status characteristic of gender is made more salient through gendered social exclusion. Thus both token men and token women should exhibit cortisol response when they are subjected to gendered social exclusion. Women should exhibit a response because their low status is being made especially salient and

men because their taken-for-granted, high status is not being recognized.

The data collected in Experiment 1 do not allow me to distinguish between these two explanations for stress response among token men and women who are subjected to gendered social exclusion. In this experiment I measure the cortisol response among token and women exposed to gendered social exclusion, and I expect to find a similar stress response. However I cannot determine if there are sex differences in the reasons for the sex response. All of the tokens were subjected to a fairly high level of exclusion and for this reason I expect that tokens in general will have a strong reaction to this exclusion. This strong response of both women and men makes it difficult to disentangle exactly why they are having strong response, with the data I collected in Experiment 1.[15]

I completed a second experiment which had the potential to isolate the gendered social experiences that can cause cortisol response. In Experiment 2 tokens were in the minority by sex in a work group, but were not socially excluded. By creating a situation in which tokens are not socially excluded I created a more socially ambiguous situation than in the first experiment. I expected this relative social ambiguity to yield more variation in cortisol response. And I expected that cortisol response should vary based on the individual token's interpretation of the social environment in the group. Specifically I predict that in this relatively socially ambiguous situation, tokens' perceptions of their status in the working group will matter in gendered ways.

As stated above I expect that when the token is both the minority and being socially excluded in a gendered manner the threat to social status will be strong and unambiguous enough to cause a cortisol response for both men and women. However,

[15] However, as reviewed above, Experiment 1 does have the potential to provide evidence that under truly negative social conditions both men *and* women exhibit a biological stress response.

in the absence of gendered social exclusion I expect there to be more ambiguity in the social cues received by the token member of the group. Thus there is more room for cortisol response to be determined by subjective evaluations of the minority member's position in the group. I expect that subjective perceptions of status will be especially important to understanding sex differences in responsiveness when participants are the minority member of a group but *not* subjected to gendered social exclusion (as occurred in Experiment 2).

I again rely on SCT to develop potential predictions regarding the effects of subjective perceptions of one's own status in the group. I argue that cortisol response to subjective perceptions of status might differ by sex in this relatively socially ambiguous situation (see the box on the bottom right side of Figure 1). As noted above, men and women will have very different taken-for-granted expectations of status in a group comprising members of the opposite sex. Men will expect to be treated as more competent and more influential than other members of the group and women will not. In this sense then, men have more status to lose than women. For men there is the pressure of maintaining high status in a group of lower status others (women). In this case a subjective perception of status in the group may be an especially important predictor of cortisol response among token men who are not socially excluded. On the other hand women may have a stress response solely to being a member of a group (that is, women) with a low value of a status characteristic working a in group comprising members with a higher value of a status characteristic (that, is men)—even if she is not being socially excluded.

However, it is possible that neither of these processes will be strong enough to cause a stress response in this population—especially a cortisol response. Previous work on cortisol response has indicated that cortisol responds reliably only when there is a combination of types of social stressors—or when there is one very strong social

threat (Dickerson and Kemeny 2004). Thus, it is there is some reason to expect that—when not socially excluded—token women will exhibit a stress response, token men will exhibit a stress response, both groups will exhibit a stress response or possibly neither group will. I further develop the logic behind these potential predictions below. In addition I specify which of these predictions I expect to be substantiated by the data collected in Experiment 2.

Men are likely to be seen as a natural leader of a group or thought highly of by group members, especially when that group is made up of members with a lower value on the status characteristic of gender (that is, women) (Correll and Ridgeway 2003; Kimmel 1994). In addition empirical and theoretical work in the area of masculinities has shown that ideals of masculinity are highly confounded with status maintenance and that consequently men are especially responsive to threats to both status and masculinity (Kimmel 1994; Willer In Preparation). I argue then that token men have a higher taken-for-granted status than women and will therefore be highly responsive to perceived threats to this status. In a task-oriented group in which a man is working with all women and he is not being socially excluded, he may or may not feel that his taken-for-granted status is threatened. In this case then, his cortisol response should be dependent on his own perception of his status in the group.

In sum, token men who are included in the conversation will have variability in their level of cortisol response—variability which depends on the man's own perceptions of his level of status in the group. Men who feel that they are being treated as relatively low status in a group of women will have a relatively high level of cortisol response. Men who feel that they have a high status in a group of women will have a relatively low level of cortisol response.

Women may also exhibit a stress response to being a token who is not subjected to gendered social exclusion. It may be that simply the skewed sex

composition of the group is sufficient to make her low value on the status characteristic of gender salient. On the other hand, if a woman perceives that she is relatively low status in the group, but is included in the social interaction in a normal and gender-neutral manner (as she was in this experimental scenario) she may not be especially threatened. Her taken-for-granted position in the group is not disrupted and she may therefore exhibit a minimal stress response. Using a measure of perceptions of status in the group will allow me to determine if perceptions of status in the group are especially important to low status tokens such as women. I expect that in general women tokens will not be especially responsive to perceptions of status in the group, when their low status is *not* being made salient and amplified through gendered social exclusion.

In addition I use a measure of self-perception of status to bolster the claim that this cortisol response in relatively ambiguous social situations indeed arises from status processes. I do so by measuring the stress response of other high and low status groups in these experiments: college seniors and racial/ethnic minorities. I expect that, much like men working with women, college seniors will have a high level of cortisol response if they perceive that they are seen as low status by group members who are first-years, sophomores and juniors. I also expect that, much like women working with men, African-Americans and Latinos working will have a low level of cortisol response if they perceive that they are seen as low status by group members who are white.

Summary and Theoretical Predictions for Cortisol Response

I expect that women and men will exhibit similar cortisol responses to being subjected to gendered social exclusion while in the minority in a work group by sex,

based on Epstein's (1988), and similar, work. However, there should also be theoretically predictable differences in the mechanisms through which cortisol will be activated for men and women. I also predict that these mechanisms can be understood as culturally determined understandings of the relationship between masculinity, femininity and status.

I expect that women and men will exhibit similar levels of cortisol response when exposed to very negative and identical social conditions. However, I also argue that the gendered meanings of these social conditions can vary by sex. Therefore, women and men may exhibit a cortisol response to the social conditions of minority status by sex and gendered social exclusion for different reasons based on their experiences of, and expectations for, social status in the group. First I expect that token women will exhibit a cortisol response to being a low-status member of a male-dominated group in which the status characteristic of gender is made more salient through social exclusion by men in the group. Second men will exhibit a cortisol response due to the threat presented by gendered social exclusion to their taken-for-granted high status in a group of women. However, when token men are not socially excluded their level of cortisol response will depend on their perceived level of status in the group of women. In contrast, when token women are not socially excluded I expect their cortisol response to be both relatively low and not dependent on their perceived level of status in the group.

With the data collected for this dissertation I am not able to demonstrate the different paths to stress response between token men and women subjected to gendered social exclusion. That is, I only measure the cortisol response of token women and men subjected to gendered social exclusion and whether the level of that stress response differs by sex. I do not have a measure of the nature of the status threat in the gendered social exclusion conditions that could reasonably serve as a measure

of the gendered differences in the pathways to cortisol response for men and women. I do however have measures of self-perception of status. These measures will allow me to test the claim that the stress response of token men who are not socially excluded will be dependent on these men's subjective perception of their status in the group.

CHAPTER 3

STUDY 1: PERCEPTIONS OF WORKPLACE SUPPORT BY OCCUPATIONAL MINORITIES

In Chapter 1 I presented an overview of the central questions addressed in the dissertation (see Figure 1). In Chapter 2 I presented a more in-depth explanation for why these questions are linked as they are in Figure 1. In Chapter 3 I will describe the findings from Study 1.

I developed Study 1 to address the first new question presented in Figure 1 (see the box in the middle of the top row of Figure 1). That is, is sex composition at the occupational level is associated with a negative social environment? This question is informed by previous work which finds that sex composition at more micro-levels (such as the workgroup or firm) can cause negative social environments for token women and positive social environments for white token men (see the box in the top, left corner of Figure 1). In Chapter 3 I utilize analyses of nationally-representative survey data because national level data can demonstrate that there is a similar association between occupational compositions at the national level and that this association holds across many occupations. Specifically, these analyses demonstrate that occupational minority women perceive low levels of workplace support and that occupational minority men perceive high levels of workplace support.

Describing and Restricting the Dataset

I analyze data from the first wave of the National Survey of Midlife Development in the United States (MIDUS) (Brim et al. 2000). The MIDUS data were collected in 1995 and cover a variety of topics related to work, health, and mid-life

development. Respondents were drawn from a random digit dial, nationally representative sample of non-institutionalized English-speaking adults between the ages of 25 and 74, selected from working telephone banks in the contiguous United States. The survey was administered in two parts: an initial telephone interview and a follow-up written questionnaire. Seventy percent of those contacted by phone agreed to be interviewed and were also sent a survey within a week of participating in the phone interview. Eighty-seven percent of these returned the mail-in survey yielding a combined response rate of sixty-one percent (.70 × .87 = .61). The analytic sample (N=1,808) is approximately 60 percent of the full sample and includes only respondents who had data on all of the relevant measures. This includes respondents who were currently working for pay, answered at least one item on the index measuring perceived support in the workplace and who had been coded for having a current occupation. All analyses employ a sample weight that adjusts for differences in probability of selection and differential non-response, in order to increase the representativeness of the sample (Brim et al. 2000).

Dependent Variable: Perceived Support at Work

This index comprises five items measuring perceived support from co-workers and supervisors (Bosma et al. 1997). The items are how often the respondent feels she or he: a) gets help and support from co-workers, b) is listened to by co-workers about work related problems, c) gets information she or he needs from supervisors and superiors, d) gets help and support from immediate supervisors, and e) is listened to by supervisors about work related problems. Responses are measured from one (never) to five (all of the time) (α = .90). Items are summed and divided by five and higher values on the index represent higher levels of perceived support. If the respondent

responded to fewer than five items, the available items were summed and divided by the number of available items for that respondent.

Independent Variables

The primary independent variables are sex of the worker and the proportion of women in the occupation. Sex is a dichotomous variable (woman = 1). The proportion of women in the respondent's occupation is coded as the actual proportion of women, according to nationally representative data. The occupation of each respondent reported in the MIDUS data is linked with a measure that indicates the number of women that reported being in the respondent's occupation in 1995 CPS data (using 3-Digit Occupational Codes). The resulting measure was used to compute the proportion of women in each respondent's occupation in 1995.

Other Variables

In my analyses I test for the specific relationship between perceived workplace support, the sex of the worker and sex-composition of the occupation. I control for other variables that may interact with sex of the participant or the sex-composition of the occupation to affect perceived support in the workplace, in order to avoid potential bias of the parameter estimates.

Occupational level characteristics. To adjust for the effects of occupational characteristics that may affect perceived support in the workplace, I include characteristics of workers in the occupation as well as occupational skill requirements. Occupational-level characteristics of workers are derived using 3-Digit Occupational Codes from CPS data. These characteristics are the proportion of workers in the

occupation who are college graduates, working part-time, and who are white; as well as the average weekly earnings of workers in the occupation. I also control for measures of gendered occupational skill requirements derived from the O*NET 3.1 database by Cha (2009). The measures were originally introduced by England and Kilbourne (1989) and modified by Grusky and Levanon (2008). They document the degree to which occupations require math, analytical, technical, verbal, and nurturance-communal skills as well as physical strength and authority. I also include a measure of the extent to which the workplace is physically demanding or unpleasant (for example, clean conditions) (disamenities). These items measure the degree to which an occupation required these skills (or in the case of disamenities the degree to which a workplace was physically demanding or unpleasant) based on assessments by workers in the occupation, experts or by England (1992). For more detail on how these items are measured see England 1992 (128-148).

Individual level characteristics. I adjust for variables at the individual level using the MIDUS data. Three race dummy variables are included in the analyses (Black, Asian, and Other; white is the omitted category). Three education dummy variables are also included in the analyses (less than high school, high school or GED, and some college; college degree or higher is the omitted category). Economic instability is also a dummy variable – whether there ever was a time in the past five years when the respondent did not have a telephone in his or her home or apartment (1 = yes). Parental status is also coded as a dummy variable; respondents who have children under the age of 6 in the household are coded 1. The control variables also include a dummy variable indicating if the respondent supervises at least one person on the job.

Three measures of whether the respondent is especially likely to seek support and perceives high levels of support outside the workplace are included in the models.

If I find an effect of sex while controlling for propensity to seek or perceive support, then this effect is likely not due to essentialist notions of women as simply more socially needy, and more likely to seek information, than men. The first two of these variables are constructed as the mean of Likert-scale agreements with the relevant statements. They are indices ranging from one to four, where a four indicates higher levels of advice seeking or self-sufficiency. The two measures of support seeking are: advice seeking ("I like to get advice from others before making a decision"; "When I'm upset about something, I feel better after I talk it over with others"; and "I prefer to make decisions without input from others"; $\alpha = .61$) and self-sufficiency ("I don't like to ask others for help unless I have to"; "I would rather deal with my problems by myself"; "Asking others for help comes naturally for me"; and "I don't let others know when things aren't going well for me"; $\alpha = .68$). The measure of perceptions of support outside the workplace is the average number of hours per month that the participant reports that he or she (or family members living with him or her) receives unpaid assistance from four categories of the participant's friends and family: parents; in-laws; grandchildren or grown children; other family members or close friends; $\alpha = .58$).

The respondent's perception of gender discrimination is also measured. Respondents were given a list of negative life events (such as being "fired from a job") and asked whether they had ever experienced one of these events due to discrimination. They were then asked on what personal characteristic this discrimination was based. If a respondent reported that he or she had experienced at least one incident of discrimination and that incident was based on gender, then gender discrimination is coded as 1.

The final six control variables are all constructed as the mean of Likert-scale agreements with the relevant statements. The first five measures are indices which

range from one to four, where a four indicates higher levels of the measure. First, personality measures based on inventories measuring the "Big Five" conceptualization of personality are included (Lachman and Weaver 1997, 3). Again, these measures were included to minimize the possibility of essentialist explanations for differences in perceived workplace support between women and men. That is, to rule out the possibility that men and women simply have different personalities—differences which explain differences in perceptions of workplace support. Respondents were asked how much each of the adjectives described them. The five personality dimensions are: extraversion (outgoing, friendly, lively, active, talkative; $\alpha = .78$), neuroticism (moody, worrying, nervous, calm; $\alpha = .74$), conscientiousness (organized, responsible, hardworking, careless; $\alpha = .58$), agreeableness (helpful, warm, caring, softhearted, sympathetic; $\alpha = .80$), and openness to experience (creative, imaginative, intelligent, curious, broadminded, sophisticated, adventurous; $\alpha = .77$).

The final control variable is current level of positive affect ($\alpha = .91$) (Mroczek and Kolarz 1998). Respondents may be more likely to perceive higher levels of support when they are experiencing higher positive affect. Respondents were asked how much of the time, during the past 30 days they felt "cheerful"; "in good spirits"; "extremely happy"; "calm and peaceful"; "satisfied"; and "full of life" on a scale of one ("all of the time") to five ("none of the time") and items were re-coded so that higher scores reflected higher levels of positive affect.

With this set of control variables, if I find a significant effect it is most likely not due to required occupational skills, average levels of pay, education, work hours or racial composition of the occupational category. In addition significant effects are not likely due to individual race/ethnicity, parental status, economic instability, being a supervisor, sensitivity to discrimination, likelihood of seeking or perceiving support, personality traits or current level of positive affect.

Analysis Strategy

There are two possible analytic strategies for measuring the sex-composition of occupations: categorical (for example, defining occupational-minorities as workers who are in the numerical minority at 15 percent or less, as Kanter's (1977) classic work on tokens originally suggested) and continuous (using all possible levels, from 0 to 100 percent women). I present analyses using both approaches but use a continuous measure in the main regression analyses because this strategy does not impose an arbitrary cutoff and allows for intuitive analyses across the full spectrum of sex-composition of occupations.

In the main models, perceived level of workplace support is regressed on the proportion of women in the occupation of the respondent. To estimate a curvilinear relationship the square of the proportion of women in the workplace is included. Earlier work using a similar, though more narrow, measure of workplace support and a smaller dataset reveals the need to test for a curvilinear relationship in order to fully understand the relationship between perceived workplace support and sex-composition (South et al. 1982). The hypothesized difference between being an occupational-minority man and an occupational-minority woman is modeled as an interaction between the sex of the respondent and the squared proportion of women in the occupation (this model also includes a lower-order term in which the sex of the respondent is interacted with the proportion of women in the occupation). That is, the main models test for the relationship between perceived workplace support, sex of the worker, and sex-composition of occupation—while simultaneously testing for the possibility that the relationship between perceived workplace support and sex of the worker may be different at different levels of sex-composition of occupations.

Descriptive Overview

Table 1 contains descriptive statistics for the variables measured at the individual level. Approximately half of the respondents in the sample are women. Women in the MIDUS data report higher levels of workplace support (3.73) than men (3.58), which is consistent with previous research. In addition women in the MIDUS data are much more likely than men to report an incident of gender-based discrimination (30 percent of women as compared to 6 percent of men). Finally, men are more likely to be supervisors than women (54 percent versus 40 percent).

Table 1. Means and Standard Deviations of Individual-Level Variables for Full Sample and by Sex

	Men		Women		Total Sample	
	Mean	SD	Mean	SD	Mean	SD
Perceived Work Support	3.58	0.02	3.73	0.03	3.65	0.02
Woman Respondent					0.48	0.01
Neuroticism	2.16	0.02	2.33	0.02	2.24	0.02
Extraversion	3.16	0.02	3.26	0.02	3.20	0.01
Contentiousness	3.38	0.01	3.50	0.01	3.44	0.01
Openness	3.10	0.02	3.02	0.02	3.06	0.01
Agreeableness	3.34	0.02	3.62	0.01	3.48	0.01
Supervisor	0.54	0.02	0.40	0.02	0.47	0.01
Ever Felt Discriminated Against Based on Gender	0.06		0.30		0.17	
Good Mood	3.39	0.02	3.33	0.02	3.36	0.02
Race ("white" is omitted)						
Black	0.05		0.08		0.06	
Asian	0.01		0.01		0.01	
Other	0.05		0.04		0.05	
No Phone in Past Five Years	0.04		0.04		0.04	
Self-Sufficient	3.13	0.02	3.04	0.02	3.08	0.01
Advice Seeking	2.69	0.02	2.77	0.02	2.73	0.02
Any Children	0.48		0.40		0.44	

Table 2[16] contains descriptive statistics for the variables measured at the

[16] Sources: MIDUS data; 1995 CPS Data; O*NET 3.1

occupational level.[17] Women in the MIDUS data are more likely to be in an occupation comprising primarily women than are men. Men are more likely to be in occupations with higher average earnings and women are more likely to work in occupations in which a higher proportion of people work part-time. Women are more likely to be in occupations which require higher levels of verbal and nurturance-communal skills; men are more likely to be in occupations which require higher levels of physical strength and authority as well as math, analytical, and technical skills.

[17] The components of the "Occupational Skill Measures" indices are standardized around a mean of zero, so that each item contributes equally to the index. This is why in the full sample the means of these scales are roughly zero. See Cha (2009).

Table 2. Means and Standard Deviations of Occupational-Level Variables for Full Analytic Sample and by Sex

	Men		Women		Total Sample	
	Mean	SD	Mean	SD	Mean	SD
Occupational Characteristics:						
Proportion Women	0.30	0.23	0.65	0.26	0.47	0.30
Proportion College Graduates	0.41	0.28	0.43	0.29	0.42	0.29
Average Weekly Earnings	647.22	216.39	514.38	213.35	583.01	224.89
Proportion Part-Time Workers	0.15	0.08	0.23	0.11	0.19	0.10
Proportion White Workers	0.87	0.07	0.85	0.07	0.86	0.07
Occupational Skill Measures:						
Strength	0.13	1.04	-0.17	0.81	-0.01	0.95
Disamenities	0.26	0.94	-0.30	0.58	-0.01	0.83
Math	0.07	1.02	-0.02	0.84	0.03	0.94
Analytical	0.13	0.99	-0.14	0.87	0.00	0.95
Authority	0.09	0.98	-0.09	0.92	0.00	0.95
Technical	0.29	0.99	-0.31	0.57	0.00	0.87
Nurturance-Communal	-0.16	0.85	0.20	0.80	0.01	0.84
Verbal	0.01	1.04	0.06	0.88	0.03	0.96

Perceptions of Workplace Support

The primary goal of this study is to explore how women's and men's perceptions of access to work-related information, help, support from supervisors and co-workers in the workplace vary according to the sex-composition of their occupations. To examine this question it is first important to establish baseline differences in perceived support in the workplace by the sex of the worker, without considering the sex-composition of the occupation.

To do this, I regressed perceived access to workplace support on the sex of the respondent (controlling for fifteen characteristics of the respondent and twelve occupational-level characteristics). Results indicate that women report higher levels of support in the workplace than men report (b = .154, $p \leq$ .01) (Table 3[18], Model 1). This shows that, net of the relevant characteristics measured by the control variables, women's scores on the scale of workplace support are .15 points higher on a one to five scale than men's. I also executed a model in which I included the proportion of women in the occupation, as well as a squared-term for the proportion of the women in the occupation (Model 2, Table 3). In this model, the effect of sex remains statically significant, but the effect of the proportion of women in the occupation is not significant. In the next table I demonstrate that the effect of the sex of the worker should be considered at the same time as the occupational sex-composition (see Table 4).

[18] All analyses in Tables 3 and 4 control for occupation-level variables: proportion college graduates, average weekly earnings, proportion part-time workers, proportion white, strength, disamenities, math, analytical, authority, technical, nurturance and verbal. And all analyses control for individual level personality traits: neuroticism, extraversion, contentiousness, openness and agreeableness. All analyses also control for individual-level self-reported level of self-sufficiency, advice seeking and perceived support from friends and family. All analyses also control for level of education of the individual.

Table 3. Regression of Perceived Support in the Workplace on Proportion of Women in Occupation and Sex of Respondent

	Model 1 Sex	Model 2 Sex-Squared
Main Effects		
Woman Respondent	0.154**	0.162**
	(0.052)	(0.054)
Proportion of Women in Occupation		-0.180
		(0.409)
Proportion of Women in Occupation - Squared		0.111
		(0.352)
Control Variables		
Race (Omitted Category = white)		
Black	0.191*	0.193*
	(0.079)	(0.078)
Asian	0.141	0.137
	(0.139)	(0.139)
Other	0.130	0.132
	(0.109)	(0.110)
No Phone in Past Five Years	-0.217	-0.219
	(0.113)	(0.113)
Any Children Under Age Six	-0.037	-0.037
	(0.050)	(0.050)
Intercept	2.393**	2.483**
	(0.409)	(0.433)
R^2	0.1002	0.1004
N	1808	1808

NOTE*:* Numbers in parentheses are robust standard errors.
*$p \leq .05$ * (two-tailed) $p \leq .01$ ** (two-tailed)*

Do occupational-minority men and occupational-minority women perceive different levels of workplace support? Do occupational-minorities perceive different levels of workplace support than workers in more sex-balanced occupations? Figures 2 and 3 illustrate the same basic results using two different approaches to conceptualizing occupational minorities: a continuous measure of occupational sex-composition and a 10 percent occupational-minority cutoff. I present the mean levels

of perceived support using a 10 percent occupational-minority cutoff (Figure 2), before turning to regression analyses that use a continuous measure.

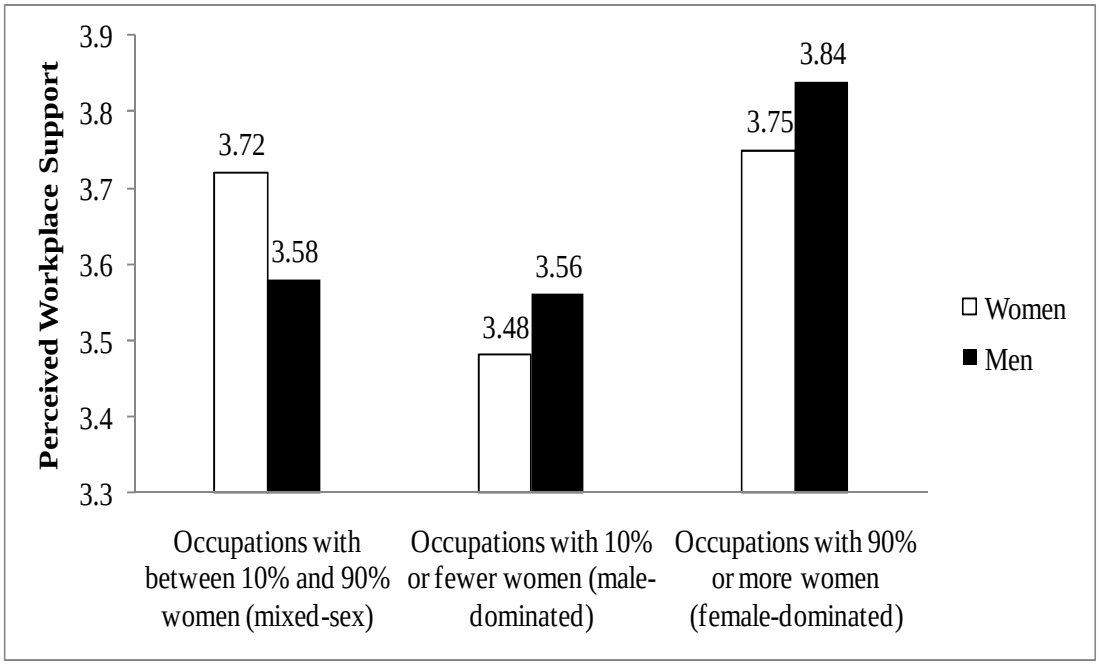

Figure 2: Mean Level of Perceived Workplace Support at 10 Percent Cut-off Points

In Figure 2, occupational minority women are represented by the white bar in the middle and occupational minority men are represented by the black bar at the right side. As can be seen, ccoupational minoirty men have much higher levels of perceived support than occupational minoirty women. Figure 2 presents the mean levels of perceived workplace support at three points: when women comprise less than 10 percent of the occupation, when women comprise greater than 90 percent of the occupation, and when women comprise between 10 percent and 90 percent of the occupation. The highest level of perceived workplace support is reported by occupational-minority men at 3.84 (n=12) (see the black bar on the far right side of

Figure 2). This is relatively high compared to men in more mixed sex occupations at 3.58 (n=672). The lowest level of perceived workplace support is reported by occupational-minority women at 3.48 (n=16) (see the white bar in the middle of the figure). This is relatively low compared to women in more mixed-sex occupations at 3.72 (n=652).

The 10 percent cutoff is an arbitrary division and the sample sizes of some groups are very small. Nevertheless, this figure suggests that occupational-minority men have the highest levels of perceived workplace support while occupational-minority women have the lowest levels. In addition same trend holds at another set of cut-off points: when women comprise less than 20 percent of the occupation, when women comprise greater than 80 percent of the occupation, and when women comprise between 20 percent and 80 percent of the occupation (analyses not shown).

I use ordinary least squares regression (OLS) to test these relationships over the full range of proportions of women in an occupation. I regress the perceived level of workplace support on the squared proportion of women in the workplace interacted with sex (controlling for sex, proportion of women in the workplace, squared proportion of women in the workplace, fifteen characteristics of the respondent, and twelve occupational-level characteristics) (Table 4, Model 1).

Table 4. Regression of Perceived Support in the Workplace on Interaction of Proportion of Women and Sex

	Model 1
Main Effects	
Woman Respondent	-0.082
	(0.160)
Proportion of Women in Occupation	-0.722
	(0.489)
Proportion of Women in Occupation × Woman Respondent	1.283
	(0.661)
Proportion of Women in Occupation - Squared	0.800
	(0.514)
Proportion of Women in Occupation - Squared × Woman Respondent	-1.295*
	(0.640)
Control Variables	
Supervisor	0.139**
	(0.045)
Ever Felt Discriminated Against Based on Gender	-0.056
	(0.053)
Good Mood	0.195**
	(0.032)
Race (Omitted Category = white)	
Black	0.188*
	(0.078)
Asian	0.133
	(0.134)
Other	0.131
	(0.109)
No Phone in Past Five Years	-0.222*
	(0.113)
Any Children Under Age Six	-0.034
	(0.050)
Intercept	2.513**
	(0.435)
R^2	0.1030
N	1808

NOTE*:* Numbers in parentheses are robust standard errors.

*$p \leq .05$ * (two-tailed) $p \leq .01$ ** (two-tailed)*

The coefficient associated with the interaction term between the squared proportion of women in the occupation and sex indicates that the difference between men and women is statistically significant[19] (b= -1.295, $p \leq .05$).[20] This coefficient demonstrates two important aspects of the relationship between perceived support, sex of the worker, and sex-composition of the worker's occupation. First, the relationship between occupational sex-composition and perceived support is dependent on the sex of the worker. Second, the relationship between the sex-composition of the occupation and perceived support is in the form of a curve. These relationships are best illustrated in Figure 3, which provides a visual representation of the predicted values of perceived workplace support across proportions of women in the workplace from Model 3.

[19] All references to statistical significance refer to the standard $p \leq .05$ cutoff. Marginal significance refers to the standard $p \leq .10$ cutoff.

[20] Because the data are clustered on occupation I considered the inter-class correlation before deciding to use OLS. However, for all models including occupation as a random effect, the inter-class correlation was zero. Thus, the results would be the same whether I controlled for occupation as a random effect or not. In order to utilize weights to make the MIDUS sample nationally representative I choose to use OLS.

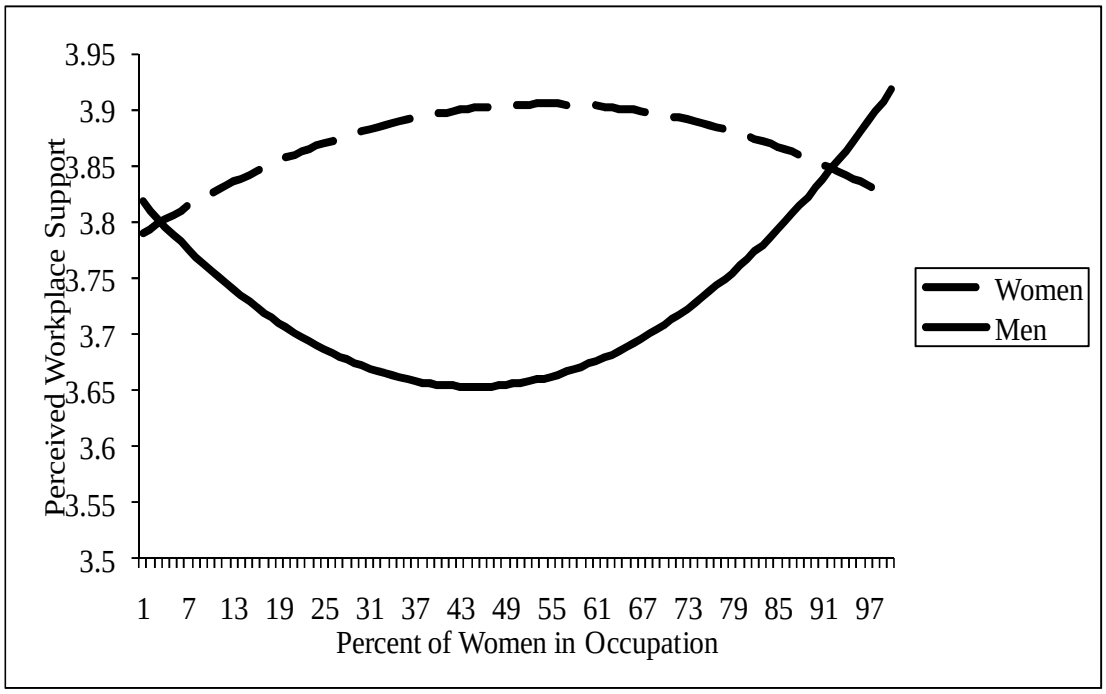

Figure 3: Perceived Level of Workplace Support by Percent Women

Figure 3 demonstrates that in occupations with a skewed sex-composition, men perceive higher levels of support than women. As can be seen by the dashed line on the left side of the figure, women who are occupational-minorities perceive lower levels of support than both their co-workers who are men, and than women in more mixed-sex occupations. Conversely, as can be seen by the solid line on the right side of the figure, occupational-minority men perceive higher levels of support than both their co-workers who are women and than men in more mixed-sexed occupations. In addition, as illustrated by the middle of the figure, in relatively mixed-sex occupations women perceive a higher level of support than men.

There is also a significant and positive effect on perceptions of workplace support with being Black (Table 4, Model 1) (b= 0.188, $p\leq .05$). It is difficult to determine what this means in the absence of analyses that control for the racial

composition of the occupation of the respondent. It may be, as recent work has suggested, that workplace interactions and outcomes are shaped by the intersections of race and sex (for example, racial minority men who are also occupational minorities may not gain the same status and benefits as their counterparts who are white men (Wingfield 2009)).

I also estimated this model with several variations in order to establish that the main interaction effect of interest is stable and robust to modifications. I first estimated this model controlling for several other key variables: income (logged), age, years of work experience, and two more general types of support from friends and family (received emotional support and received instrumental support). In these models the results remain statistically significant and in the predicted directions. I do not include these variables as controls in the main models because there are many respondents who do not have responses on one or more of these items. In addition, I estimated all of the models using a measure of perceived workplace support constructed differently. Instead of keeping all participants who answered at least one of the five items on the index I kept only participants who had a valid value for all of the five items on the index. This yielded a smaller sample size (N=1,631), however the results remained statistically significant and in the predicted direction. Finally, I also used multiple imputation (using the "mi impute" command in STATA) to impute both missing values on the dependent variable and all of the independent variables and to impute only missing values in the independent variables. In both cases the results remained essentially the same as the results reported above. In sum, I made several modifications to the main models and the effects remain statistically significant and in the same direction in all cases. This suggests that the reported effects are reasonably robust to modifications.

CHAPTER 4

STUDY 2: STRESS RESPONSE TO THE TOKEN EXPERIENCE

Qualitative interviews and ethnographic work have provided rich descriptions of the fact that women in male-dominated occupations face negative social environments in the workplace (see the box on the top left of Figure 1). Study 1 provides evidence that this occurs widely across male-dominated occupations (see the box in the middle on the top of Figure 1). However this research has not demonstrated that the experience of being a token woman subjected to a negative social environment has a causal relationship to stress response. Demonstrating that the experience of gendered social exclusion of token women can actually cause stress response—especially a stress response associated with negative health outcomes—is important in light of prevailing claims that token women are "too sensitive" and need to "toughen up" if they want to fit-in in male-dominated occupations. In addition it is important to understand stress response among token women because chronic stress response can limit individuals' career outcomes and satisfaction.

The first of my two experiments is designed to demonstrate the causal relationship between stress response and being a token woman subjected to a negative social environment. I focus specifically on the negative social environment created by gendered social exclusion and token status. In Experiment 1 I will also examine the question of whether women and men respond differently to the type of gendered social exclusion that token women are exposed to in the workplace.

The second experiment is designed to demonstrate whether minority status alone can cause a stress response, and if so, whether this stress response differs by sex. In addition the second experiment allows me to test the effect of perceptions of status in a workgroup on stress response.

In these two experiments I create a scenario in a social psychological laboratory that closely mirrors two theoretically important aspects of being a token: gendered social exclusion and minority status by sex. By creating specific components of the token experience in a laboratory I can determine if these components of being a token are stressful, and if so, for which sex.

Procedure

Upon arriving at the lab the participant was greeted by an experimenter, brought into the laboratory, and seated at a desk in a private cubicle. After giving written consent to participate in the study the participant was told that he or she was participating in a study of small group interaction. As part of the cover story the participant was also told that the purpose of the study was to examine how hunger affects group interactions and that the experimenter would take measures of glucose and electrolytes throughout the study by collecting saliva samples. The saliva samples were actually used to obtain measures of cortisol. This cover story was used to divert suspicion from the true focus of the study (stress response).

The experimenter then provided detailed instructions to the participant on how to give a saliva sample. The participant was then left to give the saliva sample in the privacy of his or her cubicle. After giving an initial saliva sample, the participant filled out a baseline questionnaire and read travel magazines (a common filler task in laboratory experiments measuring cortisol response) to prevent stress response due to boredom or inactivity. After 35 minutes the participant gave a second saliva sample. This second sample constitutes the baseline measure of cortisol in my analyses. The preliminary questionnaire is used to collect basic demographic information, the participant's gender ideology, the participant's propensity towards social dominance,

the participant's level of social interdependence or independence and the participant's subjective appraisal of baseline stress level, mood and anxiety.

The participant was then seated at a table with the three students who were confederates: undergraduate research assistants trained by me to enact the experimental conditions. Thus, all participants were members of a four person decision-making group in which only one of the group members was an actual study participant. Participants believed that the other members of the group were naïve participants like themselves and that the sex composition of the group was a coincidence.

The experimenter then instructed the group to work on a problem-solving task together for five minutes. The task is an adapted version of the Meaning Insight Ability (MIA) task—a problem-solving task that is commonly used in experiments on dyadic or group decision-making. Next, the group was instructed to work on a social task for twelve minutes. In this social task the participant and confederates were instructed to get to know each other as they might at a business networking event. The participants and confederates were told that the social task measures their ability to network with colleagues and clients. The instruction sheet for this interaction was carefully crafted in order to create a situation in which the participants felt that they were actually being evaluated on a social skill (that is, the ability to network) that is very important to workplace success. It was during this twelve-minute period that the experimental conditions were enacted by the confederates (see below for a detailed description of the experimental conditions).

After the social task was complete, the group spent another five minutes working on the second round of the problem-solving task. After the three group tasks were complete the participant was directed to go back to the cubicle and give a third saliva sample. This third saliva sample was collected roughly six minutes after the

hypothesized stressor (that is, the social interaction task) ended. Next the participant was instructed to fill out a second questionnaire and when he or she was done with the questionnaire he or she read travel magazines again. A fourth saliva sample was collected at exactly fifteen minutes after the end of the "social networking task". A fifth saliva sample was then collected exactly 10 minutes after the fourth sample. A sixth sample was collected exactly ten minutes later. At the end of the post-task period some last questions were administered using two very short questionnaires. Following completion of the survey measures all participants were debriefed and paid. Figure 4 (below) is an outline of this experimental protocol.

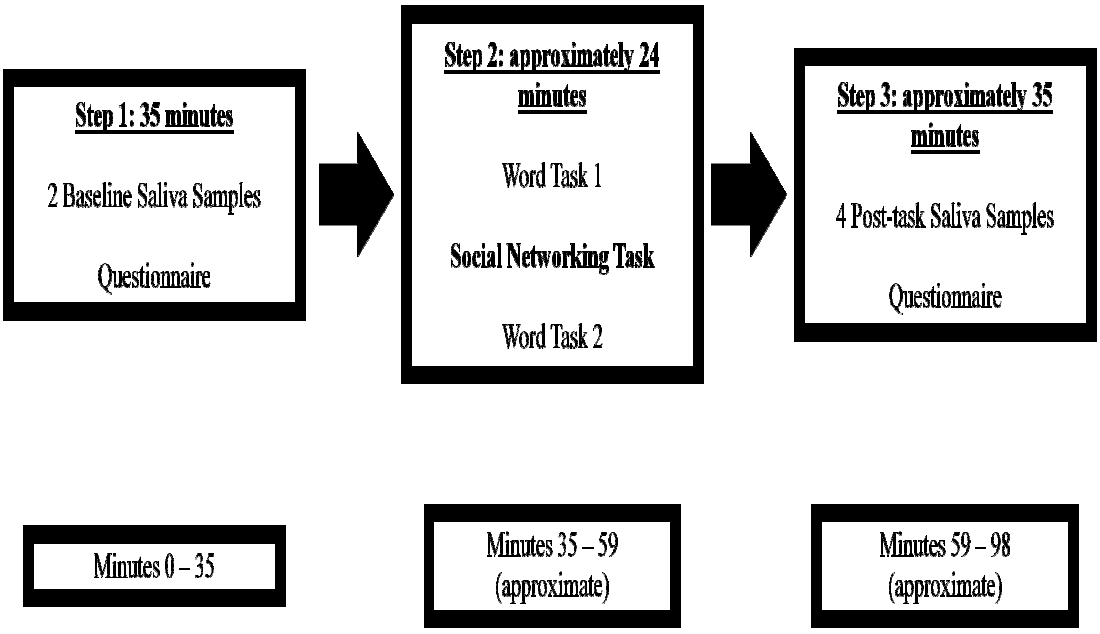

Figure 4: Protocol for Experiments 1 and 2

Throughout the entire experiment the experimenter pretended to take saliva samples as well as to administer questionnaires to the three confederates (who were

also in cubicles when the participant was in his or her cubicle). Thus, from the point of view of the participant, the confederates were being put through the same paces of the experimental protocol as himself or herself.

Manipulation

All participants in both Experiments 1 and 2 went through the procedure described above. The experimental manipulation, which varied by experiment and condition, was enacted during the twelve minutes of social interaction. Figure 5 gives an overview of the experimental manipulations in the two experiments.

Experiment 1

Treatment or Control	Sex	In Minority by Sex	Gendered Social Exclusion
Treatment	Woman	Yes	Yes
Treatment	Man	Yes	Yes
Control	**Woman**	**No**	**No**
Control	**Man**	**No**	**No**

Experiment 2

Treatment or Control	Sex	In Minority by Sex	Gendered Social Exclusion
Treatment	Woman	Yes	No
Treatment	Man	Yes	No
Control	**Woman**	**No**	**No**
Control	**Man**	**No**	**No**

Figure 5: Overview of Experimental Manipulations

Experiment 1 utilized a 2x2 design with two factors: (1) sex (woman/man) and (2) gendered social exclusion AND minority/token status (yes/no). For each trial male

and female participants were randomly assigned to one of two conditions: gendered social exclusion with minority status or gender-neutral social exclusion with majority status. Experiment 1 is represented in the top panel of Figure 5.

In the control conditions of Experiment 1 all group members were of the same sex as the participant and the confederates systematically and consistently included the participant in the conversation in a gender neutral manner (see bolded text in rows three and four of the top panel of Figure 5). In these conditions confederates talked with each other and with the participant about gender-neutral topics that are common among undergraduate students at Cornell University (major, where they are from, the cold weather at Cornell and the steep hills on the Cornell campus).

In contrast, in the treatment conditions in Experiment 1 each participant was in a group composed of confederates of the opposite sex and was subjected to an enactment of gendered social exclusion (see non-bolded text in rows one and two of the top panel of Figure 5). Confederates engaged in gendered social exclusion by talking about either stereotypically masculine or stereotypically feminine topics of conversation and by subtly excluding the participant from the conversation. Confederate men started by talking about a class in business and statistics.[21] If the woman participant tried to join in the conversation they would disregard her remarks and move on to a second topic (recent events in sports such as boxing, baseball, and football). The confederates had two other stereotypically masculine topics (video games and wrestling) to discuss if the participant persisted in trying to join in these male-typed conversations.

This gendered social exclusion is closely modeled on the boundary heightening

[21] All confederates started the 12 minute social interaction with a discussion of a relatively gender-neutral topic: college majors. This topic of conversation went on for one to three minutes during which time the participant was included in the conversation. I added this short period of inclusion to the protocol after pilot testing revealed that jumping directly into social exclusion made participants suspicious that the interaction was somehow unnatural.

described in ethnographies of the workplaces of token women. For example Pierce (1995) describes a specific boundary heightening incident in which a woman tries to socialize with a group of men in a male-dominated occupation (litigation attorneys) and is repeatedly shut out of the conversation as the men move between masculine topics.[22] In the condition described in the second row of the top panel of Figure 5, confederates engaged in a similar process except that they discussed stereotypically feminine topics (Pilates, yoga, shopping, figure skating and a class in the social development of children). In sum, the confederates were extensively trained to systematically and consistently exclude the participant in a gendered manner in the treatment in Experiment 1 (see the gray-shaded portion of Figure 5).

Experiment 2 also utilized a 2x2 design with two factors: (1) sex (woman/man) and (2) minority/token status (yes/no). For each trial male and female participants were randomly assigned to one of two conditions: gender-neutral social inclusion with *minority* status or gender-neutral social inclusion with *majority* status. Experiment 2 is described in the second panel of Figure 5. In the control conditions, all group members were of the same sex as the participant and the confederates enacted gender-neutral social inclusion. This is exactly the same control condition that was enacted in Experiment 1 (see all bolded text in Figure 5). In the treatment condition however, each participant was in a group composed of confederates of the opposite sex and the confederates again enacted gender-neutral social inclusion (see rows one and two in the bottom panel of Figure 5). Thus in Experiment 2 the only difference between the control and treatment conditions was whether the participant was in the minority by sex in the group or not. All participants were socially included in a gender neutral manner.

[22] This conversation is described in more detail on pages 29-30 of Chapter 2.

Participants

Participants in Experiments 1 and 2 were Cornell University undergraduates[23] recruited via flyers and in Sociology classes by offering payment and/or extra credit for participation in a study. Participants were informed upon recruitment that there were restrictions on food, drink, and exercise prior to the experiment and were screened for compliance with these restrictions at the end of the study via a self-report survey. Participants were screened in this manner because engaging in these activities can bias the results of salivary cortisol tests.

Describing and Restricting the Dataset

Main Dependent Variable: Cortisol Response

Cortisol was obtained though salivary measures. Saliva samples were collected during an approximately two hour laboratory session (described above). Sample 1 was obtained when the participant first arrived in the laboratory. Sample 2 was obtained exactly 35 minutes after the first sample. Sample 3 was obtained as soon as the participant went back to his or her cubicle which was roughly six minutes after the end of the social task (the task during which the gendered social exclusion manipulation was enacted in the treatment condition in Experiment 1 and during which the gender-neutral social inclusion was enacted during all of the control conditions and during the treatment condition in Experiment 2) and about one minute after the end of the second round of the word task (MIA) was completed with the group. Sample 4 was obtained

[23] One participant was a graduate student.

exactly 15 minutes after the end of the social task. This fourth sample was a key sample because previous work has demonstrated that cortisol response peaks roughly fifteen minutes after the stressor has been administered in a laboratory setting (Dickerson and Kemeny 2004). A fifth sample was obtained exactly ten minutes after the fourth sample (that is, 25 minutes after the end of the social task). A sixth and final sample was obtained exactly ten minutes after the fifth sample (that is, 35 minutes after the end of the social task).

The saliva was expressed into vials and vials were labeled with the participant's ID number and the appropriate sample number. Samples were frozen at -20°C. The samples were then sent to the Biochemical Laboratory, Psychobiology, University of Dresden, Germany to be assayed. Cortisol levels in saliva were determined by employing a CLIA (chemiluminescence immunoassay) from IBL-International, Germany. The intraassay coefficient of variation (CV) reported by this laboratory was less than 6% and the interassay CV was less than 8%, respectively.

I computed a change score in order to measure the level of cortisol response. The change score is a measure that has been used previously in laboratory studies of cortisol response (Cohen et al.1996; Nicolson 2008). I averaged the three post-interaction measures of cortisol, subtracted the second baseline measure and then divided this sum by the second baseline measure: (((Sample 4 + Sample 5 + Sample 6) - Sample 2) / Sample 2). The change score then represents the volume of cortisol response over the time in the lab, standardized by the baseline level of cortisol once the participant had had time to acclimate to the laboratory setting (Sample 2).

Cortisol has three important advantages in terms of its use as a measure of stress response in these experiments. First, as described in detail in Chapter 2, it is the ideal hormone to document the effects of the negative social experiences encountered by token women. Second a physiological measure of stress response can be used to

avoid self-report bias. And third, chronic exposure to cortisol response is associated with negative health outcomes.

Self reports of women in non-traditional occupations have shown that social exclusion from majority groups is associated with self-reported social and professional discomfort (Pierce 1995, Kanter 1977). The results of these studies are vulnerable to the criticism of possible response bias on the part of the respondent. Thus, questions remain as to impact of the chronic social exclusion reported by token women on physiological functions and health. The use of a bio-marker, such as cortisol, then has the advantage of corroborating and validating token women's accounts of their stress response to their workplace social environment. I know of no other similar attempts to use biomarkers to document stress response to a social environment similar to the one experienced by token women in the workplace (that is, an experiment in which the researchers tried to replicate a setting in which a person might be socially excluded because of his or her minority status (Dickerson and Kemeny 2004; Nicolson 2008)). Also, cortisol is a biological marker of activity of the HPA axis, which plays a vital role in linking stress response and negative health outcomes. The study of cortisol response in a sociological laboratory offers an opportunity to examine how specific social experiences and social structures can be linked to physiological responses that are indicators of health and well-being.

Main Independent Variables

The primary independent variables are sex of the participant and whether the participant was exposed to the treatment or to the control condition. Both are dichotomous variables (*woman* = 1; *treatment* = 1).

Biological Factors Known to Cause Variation in Cortisol Response

In order to avoid exposure to factors known to cause variation in cortisol response in a laboratory setting all participants were instructed not to eat a major meal within one hour of coming into the laboratory, not to consume dairy products or acidic or high sugar foods within 30 minutes of coming into the study, not to consume alcohol or have dental work performed in the 24 hours before coming into the study, not to engage in strenuous exercise in the two hours before coming into the study and not to smoke for an hour before coming into the study (Dickerson and Kemeny 2004; Nicolson 2008). Participants received these instructions via email when they first signed up for the study as well as via an email reminder 24 hours before they were scheduled to come into the laboratory.[24]

In my main analyses I also adjust for self-report of adherence to most of these guidelines. These data were collected immediately after the final cortisol sample was obtained via a short self-report questionnaire. In order to obtain the most accurate answers possible participants were reassured at the time that they filled out the questionnaire that their answers would be kept completely confidential; that they had already earned their pay or academic credit for participating in the experiment; and that their answers would not affect their pay or academic credit.

The variables (based on the questionnaire described in the preceding

[24] This is an excerpt of the exact text of the email sent to participants: "Due to the nature of this study and the test of levels of electrolytes and glucose we ask you *do not eat a major meal* within 60 minutes prior to coming in for the study. It is particularly important that you *do not consume dairy products* in the 30 minutes prior to coming in for the study. In addition please *do not consume acidic or high sugar foods* 30 minutes prior to coming in for the study. Please *do not drink alcohol* for 24 hours prior to coming in for the study. Please *do not engage in strenuous exercise* in the two hours before this study. Please do not smoke for an hour before coming in for the study. In addition, please *do not brush your teeth* for two hours before coming in for the study. Also, *dental work* should not be performed within 24 hours prior to the study. If you have dental work scheduled for 24 hours prior to the study please let us know (foodandgroups@gmail.com) and we will reschedule your time slot for participation in the study".

paragraph) that I adjusted for in my main models include a series of dichotomous variables (*yes* = 1): whether the participant had consumed any caffeine that day; whether the participant was currently taking any over-the-counter or prescription medication; whether the participant was a woman currently taking birth control[25]; whether the participant had engaged in exercise in the two hours before the study; whether the participant had consumed alcohol in the last 24 hours; whether the participant had consumed any drugs that were not prescribed to him or her (for example marijuana, cocaine, speed, etc.); whether the pattern of sleep for the participant in the previous night was typical for the participant; whether the participant had a fever; whether the participant was a woman currently in the first fourteen days of her menstrual cycle; and whether the participant had smoked in the last hour. In addition these variables consisted of two continuous variables: how many hours the participant had slept the night before and the number of minutes before 3:00 p.m. that day the participant had last had a meal.

Other Variables

Self-reported Stress and Anxiety. In addition to six salivary measures of cortisol I collected questionnaire data which measures subjective appraisals (self-report) of perceptions of stress response and anxiety felt during the group interaction and in the participant's life overall. I collected a baseline measure of subjective appraisal of stress before the group interaction and collected a second measure of

[25] Both of the dichotomous variables for whether the participant was a "woman currently taking birth control" and whether the a participant was a "woman in the first fourteen days of her menstrual cycle" were coded as zero if the participant was a man .That is, if the participant was a woman after the fourteenth day of her menstrual cycle or the participant was a man, then participant was coded as zero for the variable indicating whether the participant was a "woman in the last 14 days of her menstrual cycle". Similarly, if the participant was a woman not on birth control or was a man, then the participant was coded as a zero for the variable indicating whether the participant was a "woman on birth control".

subjective appraisal of stress on the post-group interaction questionnaire using modifications of two scales of perceived stress. The index measuring subjective appraisal of stress is a modified version of the Perceived Stress Scale and comprises six items (Cohen, Kamarck, and Mermelstein 1983). The participant rates how much he or she feels: nervous, stressed, upset, in control of the situation you are in, able to cope with the situation, and irritated with the situation. For all items the participant is asked to evaluate how he or she feels "right now". Responses are measured from one (very slightly or not at all) to five (extremely) ($\alpha = .62$). Items are summed and divided by six and higher values on the index represent higher levels of perceived stress. If the participant responded to fewer than six items, the available items were summed and divided by the number of available items for that participant. The participant answered these questions before the group interaction and again after the group interaction in the privacy of his or her cubicle.

The two indices measuring subjective appraisal of current level of anxiety ("state anxiety") and "trait" levels of anxiety are the "State-Trait Anxiety Inventory (STAI)". Each index comprises twenty items measuring self-reported level of current levels of anxiety and self-reported levels of generalized (or trait) anxiety (Spielberger, Gorsuch and Lushene 1983). For the state anxiety index, the participant rates how much he or she feels these items at the present moment. The items are: calm, secure, tense, strained, at ease, upset, worrying of possible misfortunes, satisfied, frightened, comfortable, self-confident, nervous, jittery, indecisive, relaxed, content, worried, confused, steady and pleasant ($\alpha = .91$). For the trait index, the participant rates how much he or she feels these items are a good description of how he or she generally feels. The items are: pleasant; nervous and restless; satisfied with myself; wish I could be as happy as others; like a failure; rested; "calm, cool, and collected"; difficulties are piling up so that I cannot overcome them; worry over something that doesn't matter;

happy; have disturbing thoughts; lack self-confidence; secure; make decisions easily; inadequate; content; unimportant thoughts bother me; take disappointments keenly; steady; and get in a state of tension or turmoil ($\alpha = .92$).

For both indices responses are measured from one (not at all) to four (very much so). Items are summed and divided by twenty and higher values on the index represent higher levels of perceived anxiety. If the participant responded to fewer than twenty items, the available items were summed and divided by the number of available items for that participant. The participant answered the state questions before the group interaction and again after the group interaction in the privacy of his or her cubicle. The participant answered the trait questions before the group interaction only and in the privacy of his or her cubicle.

I also computed a change score in order to measure the level of change in subjective appraisal of stress response and state anxiety, over time in the laboratory. I subtracted the second pre-treatment measure of subjective levels of stress or anxiety from the post-treatment measure and then divided this sum by pre-treatment measure of subjective levels of stress or anxiety: ((post-treatment subjective stress or state anxiety - pre-treatment subjective stress or state anxiety) / pre-treatment subjective stress or state anxiety). The change score then represents the subjective response over the time in the lab, standardized by the baseline subjective response. I created two change scores: 1) current, subjective stress and 2) state anxiety.

Self-Reported Measure of Status. The measure of the participant's self-evaluated status in the group is made up of two items which represent one's perception of social status in a group as conceptualized by SCT. As reviewed in Chapter 2, SCT conceptualizes status as influence, leadership and perceived competence in a group (Correll and Ridgeway 2003). There were only two items asked of the participants regarding their experience in the group that directly capture these ideas. I analyzed

these items both separately and combined into one index. The participant answered both questions after the group interaction in the privacy of his or her cubicle.

The first item was "I felt like I was natural leader for the group". Responses to this item were measured from one (not at all) to 5 (very much). The second item was "people in this group probably think highly of me" (Cohen and Hoberman 1983). Responses are measured from one (agree strongly) to five (disagree strongly). The second item was recoded so that higher values on both the individual items and the index represent higher levels of perceived status in the group. These two items are summed and divided by two to create an index ($\alpha = .49$). If the participant responded to fewer than the two items, the available item was used in place of the index.

Other Demographic and Control Variables. Each experiment spanned a full academic year. I created two dichotomous variables to measure which semester the participant had participated in the experiment in a given year (*semester* = 1). I also created a series of dichotomous variables to indicate which year the participant was in school (*freshman* = 1; *sophomore* = 1; *junior* = 1; *senior* = 1; *graduate student* = 1). Finally, I created a series of dichotomous race/ethnicity variable based on self-report. I created five dummy variables (*white* = 1; *Black* = 1; *Asian* = 1; *Latino* = 1; *other* = 1).[26]

Restricting the Dataset

[26] Racial and ethnic categories are highly problematized in the United States (Harris and Sim 2002). And thus, assignment into the categories of white, African-American, and Latino are often not clear-cut. In this study participants were asked, "what is your race/ethnicity?". For the purposes of data analyses I assigned participants into to a category of African-American, Latino, white, Asian or other based on this self-identification. For example a participant who answered "Caucasian/Irish" was coded as "white". There was some ambiguity in this coding scheme however. For example a participant who answered "black (some Polish, Native American, English)" was coded as "African-American". And participants who answered "Dominican" and "Puerto Rican" were coded as "Latino" (however, some Dominicans and Puerto Ricans would likely code themselves as "African-American" or "white" instead of, or in addition to, Latino). However, given the limitations of the wording of the questions on the survey, this was likely a reasonable approximation of participant's self-identification of race or ethnicity in most cases.

Data were collected for a total of 186 participants using the experimental protocol described above. Six observations were dropped from the 186 participants leaving an analytic sample comprising 180 participants. The first observation was dropped because this participant did not provide sample at Time Four (the sample exactly 15 minutes after the end of the social interaction) and this sample is key to the measurement of cortisol response in this study. The second observation was dropped because the participant knew one of the confederates very well. The third observation was dropped because the participant knew the experimenter.

The final three observations were dropped because they were outliers. There are two types of outliers in these data. The first are outliers in terms of baseline cortisol; that is, participants who came into the lab with an unusually high level of cortisol. The second type is participants who are outliers in terms of their level of response to a given treatment; that is, participants who had an unusually high level of cortisol response to the treatment into which they were assigned.

The third observation that I dropped falls into to the first category of outliers. I dropped this participant from the analytic sample because she was an extreme outlier in terms of her baseline level of cortisol. The cortisol level of this participant was 76.93 at the first sample (the rest of the cortisol profile was: 59.32, 37.91, 48.86, 59.24 and 17.01). The cortisol level of the next highest participant at sample one (when participants in both Experiments 1 and 2 were pooled) was nearly two times lower than that of the dropped participant at 38.59 (the rest of the profile for this participant was 16.41, 12.73, 11.35, 9.95 and 9.5). In addition the cortisol level at sample one of the next highest participant was 32.74 – a number which is quite close to 38.59. That is, there is a very large difference between the dropped outlier's cortisol level at sample one and the next closest cortisol level at sample one (76.93 vs. 38.59) while

after that the difference between sample one levels of cortisol immediately become much smaller (38.59 vs. 32.74). This dropped participant was a woman in the experimental group in Experiment 2.

The other two participants who were dropped from the analytic sample fell into the second category of outliers—those participants who had an unusually high level of cortisol response to the treatment into which they were assigned. I dropped these two participants from the analytic sample based on the following criterion: if the participant had a change score that was over two times as high than the next highest change score in that condition, then the participant should be dropped from the analytic sample. Only two participants met this criterion. First, the fourth participant who I dropped from the analytic sample had an extremely high (relative) response to being in the control condition in Experiment 1. His change score was 1.92 which was more than twice as high as the change score of the next most responsive participant in the control condition in Experiment 1 (1.92 vs. .80). This participant also reported having slept no hours the night before the experiment—and he was the only participant in either experiment for whom this was the case. Second, the fifth and final participant who I dropped from the analytic sample was in the treatment condition in Experiment 2. His change score was 5.57, which was more than twice as high as the next participant in this condition (5.57 vs. 2.04). In neither the treatment group in Experiment 1 nor the control group in Experiment 2 was there a change score that was two times higher than the next closest change score. Therefore, no participants from these groups were dropped from the analytic sample.

Descriptive Overview

Figure 6 shows the breakdown of the analytical samples for the two

experiments. There were 89 participants in Experiment 1 and 92 participants in Experiment 2. In Experiment 1 there were 42 men and 47 women. In Experiment 2 there were 45 men and 46 women.

Experiment 1		**Experiment 2**	
Control		Control	
Men	Women	Men	Women
19	26	23	22
Treatment		Treatment	
Men	Women	Men	Women
23	21	22	24
42	47	45	46
89		91	

Figure 6: Breakdown of Participants in Experiments 1 and 2, by Sex and Treatment

There are unbalanced sample sizes in some cells—especially in the control group in Experiment 1. In this group, there were 19 men in the final analytic sample and 26 women. The cause of this imbalance was the relative scheduling difficulty of bringing men who were participants into the lab with a team of confederate men (as compared to bringing women in with men or women with women). A possible effect of this difference in sample size could be that the men have a higher level of variability of cortisol response in the control group in Experiment 1, as compared to the women. There is some evidence for this situation. The standard deviation from the mean for men in the control group in Experiment 1 is .32 (m = -.05, n = 19). In contrast, the standard deviation from the mean for women in the control group in Experiment 1 is .25 (m = -.22, n = 26). Thus the men have more variability than the women in their level of cortisol response to being in the control condition in

Experiment 1. This could be because there are fewer participants in this condition and more participants typically reduce variability in a sample. However, this difference is small and I do not expect that the difference will affect the results in a meaningful way.

Tables 5 and 6 contain descriptive statistics for key variables used in the analyses. Table 5[27] shows means and standard deviations of variables used in the analyses in Experiment 1. Table 6 shows means and standard deviations of variables used in the analyses in Experiment 2.

[27] For this and all subsequent tables: "First 14 Days" stands for "Woman in first 14 days of menstrual cycle". In addition for all subsequent tables Yes = 1, Treatment = 1 and Female = 1.

Table 5: Means and Standard Deviations in Experiment 1

	Full Sample		Treatment Only		Control Only	
	Mean	SD	Mean	SD	Mean	SD
Race						
White	0.43		0.42		0.44	
Black	0.16		0.19		0.13	
Asian	0.15		0.14		0.16	
Latino/a	0.19		0.19		0.20	
Other	0.07		0.07		0.07	
Sex	0.53		0.48		0.58	
Year in school						
Freshman	0.33		0.25		0.40	
Sophomore	0.21		0.20		0.22	
Junior	0.20		0.23		0.18	
Senior	0.25		0.30		0.20	
Graduate Student	0.01		0.02		0.00	
Cortisol Response	-0.02	0.40	0.11	0.45	-0.15	0.29
Caffeine Today	0.30		0.36		0.24	
Minutes Since Last Meal	224.37	218.95	251.02	248.82	198.31	184.32
Medication	0.35		0.39		0.31	
On Birth Control	0.15		0.18		0.11	
Exercise	0.02		0.05		0.00	
Alcohol	0.07		0.07		0.07	
Non-Prescription Drugs	0.04		0.00		0.09	
Hours Slept Last Night	7.23	1.51	7.19	1.54	7.27	1.49
Typical Sleep Pattern	0.57		0.45		0.69	
Have Fever	0.01		0.00		0.02	
First 14 days	0.28		0.25		0.31	
Smoked in Last Hour	0.00		0.00		0.00	
Self-Report Stress (pre)	2.25	0.38	2.24	0.38	2.26	0.40
Self-Report Stress (post)	2.18	0.38	2.20	0.34	2.16	0.41
Trait Anxiety (pre)	2.10	0.50	2.04	0.50	2.16	0.50
State Anxiety (pre)	1.82	0.45	1.71	0.36	1.92	0.50
State Anxiety (post)	1.79	0.48	1.76	0.51	1.82	0.46
Perception of Status	2.98	0.79	2.66	0.75	3.30	0.69

In Experiment 1 the breakdown of self-reported race is as follows: 16% Black, 15% Asian, 19% Latino and 7% Other (this breakdown is slightly more racially diverse than the 2010 in-coming class at Cornell University (Kelly 2009)). The remainder of the sample in Experiment 1 is white (43%). These percentages are roughly evenly dispersed between the control and treatment groups. In Experiment 2, the sample is also fairly racially diverse at 11 % Black, 23 % Asian, 10 % Latino/a, and 8 % Other. The remainder of the sample in Experiment 2 is white (48%). Again, as in Experiment 1, these percentages are quite evenly distributed between the control and treatment conditions. In Experiment 2 the racial diversity of the sample is fairly similar to that in Experiment 1, though there are some differences. The first experiment has a somewhat higher proportion of Black participants (16% vs. 11%), a somewhat lower proportion of Asian participants (15% vs. 23 %) and a somewhat higher percentage of Latino/a participants (19% vs. 10%). In both experiments the percentage of white participants is just below 50 (Experiment 1: 43%; Experiment 2: 48%).

Table 6: Means and Standard Deviations in Experiment 2

	Full Sample		Treatment Only		Control Only	
	Mean	SD	Mean	SD	Mean	SD
Race						
White	0.48		0.48		0.49	
Black	0.11		0.13		0.09	
Asian	0.23		0.24		0.22	
Latino/a	0.10		0.07		0.13	
Other	0.08		0.09		0.07	
Sex	0.51		0.52		0.49	
Year in school						
Freshman	0.45		0.46		0.44	
Sophomore	0.24		0.24		0.24	
Junior	0.15		0.15		0.16	
Senior	0.15		0.15		0.16	
Graduate Student	0.00		0.00		0.00	
Cortisol Response	0.01	0.50	0.08	0.53	-0.07	0.47
Caffeine Today	0.32		0.41		0.22	
Minutes Since Last Meal	267.24	313.97	301.85	339.24	231.87	285.31
Medication	0.22		0.22		0.22	
On Birth Control	0.04		0.07		0.02	
Exercise	0.04		0.04		0.04	
Alcohol	0.07		0.09		0.04	
Non-Prescription Drugs	0.03		0.04		0.02	
Hours Slept Last Night	7.14	1.50	7.05	1.36	7.23	1.63
Typical Sleep Pattern	0.60		0.67		0.53	
Have Fever	0.01		0.02		0.00	
First 14 days	0.26		0.33		0.20	
Smoked in Last Hour	0.01		0.00		0.02	
Self-Report Stress (pre)	2.33	0.38	2.28	0.39	2.39	0.37
Self-Report Stress (post)	2.18	0.32	2.17	0.26	2.18	0.37
Trait Anxiety (pre)	2.03	0.48	2.01	0.53	2.04	0.42
State Anxiety (pre)	1.80	0.47	1.86	0.46	1.73	0.48
State Anxiety (post)	1.68	0.42	1.69	0.41	1.66	0.44
Perception of Status	3.37	0.64	3.35	0.65	3.40	0.63

In Experiment 1 the year in school of the participants is roughly evenly distributed between the four years: 33% of the sample are freshman, 21% of the sample are sophomores, 20% of the sample are juniors, and 25% of the sample are seniors. In Experiment 2, there is a slightly higher representation of freshman participants than in Experiment 1 (Experiment 1: 33% vs. Experiment 2: 45%).

Participants in both Experiments 1 and 2 have a higher mean level of cortisol response in the treatment conditions than in the control conditions (Experiment 1: .11 vs. -.15 and Experiment 2: .08 vs. -.07). In addition, participants in Experiment 1 have a higher cortisol response to treatment compared to participants in Experiment 2 (Experiment 1 difference between the mean change score in the treatment group and the control group: .26 vs. Experiment 2 difference between the mean change score in the treatment group and the control group: .16). These preliminary analyses (that is, with no statistical adjustment for other factors and with no test of statistical significance) indicate that the response to the treatment in Experiment 1 (social exclusion and minority status) is stronger than the response to the treatment in Experiment 2 (minority status alone). This result is in-line with the notion that both minority status and social exclusion should cause a stronger stress response than minority status alone.

However, caution must be taken when comparing Experiment 1 results to Experiment 2 results because participants were not randomly assigned into Experiment 1 and Experiment 2. Rather, they were only randomly assigned into the treatment and control groups within each experiment. This random assignment does however allow me to more confidently assert that the treatment in Experiments 1 and 2 do appear to increase cortisol response (in comparison to the control condition in each experiment).

In contrast to cortisol response the mean levels of self-reported, post-treatment

stress and anxiety in the treatment group are not consistently higher than mean levels of self-reported, post-treatment stress and anxiety in the control group in the two experiments. In Experiment 1 the mean level of self-reported, post-treatment state anxiety is *lower* in the treatment group than in the control group (treatment: 1.76 vs. control: 1.82). In contrast, in Experiment 1 the mean level of self-reported, post treatment stress is slightly higher in the treatment group than in the control group (treatment: 2.20 vs. control: 2.16). Similarly, in Experiment 2 the mean level of self-reported, post-treatment state anxiety is slightly higher in the treatment group than in the control group (treatment: 1.69 vs. control: 1.66). And in contrast, the mean level of self-reported, post treatment stress is again *lower* in the treatment group than in the control group (treatment: 2.17 vs. control: 2.18). As noted above, these findings are quite different than the mean cortisol response which is higher in the treatment group in both experiments. These comparisons provide evidence that a measurement of cortisol does detect a response to the treatment that cannot be reliably detected with self-report measures alone. I discuss the comparisons using a change score for self-reported anxiety and stress in the following analyses section.

Tables 7-9 show the correlations between key variables used in the analyses. None of the variables demonstrate an unexpectedly high correlation between them.

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Table 7: Correlation matrix for variables 1-20 with 1-7

	1	2	3	4	5	6	7
Cortisol Response (1)	1.000						
Sex (2)	-0.245	1.000					
Caffeine Today (3)	-0.066	0.169	1.000				
Minutes Since Last Meal (4)	0.003	-0.118	0.118	1.000			
Medication (5)	-0.039	0.185	0.097	0.034	1.000		
On Birth Control (6)	-0.089	0.311	0.072	-0.014	0.501	1.000	
Exercise (7)	0.027	-0.006	-0.056	-0.019	-0.051	-0.059	1.000
Alcohol (8)	-0.003	-0.097	-0.081	0.122	0.025	-0.085	0.075
Non-Prescription Drugs (9)	-0.088	-0.092	-0.133	-0.098	0.123	0.132	-0.037
Hours Slept Last Night (10)	-0.127	0.038	0.022	0.105	-0.052	-0.050	-0.096
Typical Sleep Pattern (11)	-0.125	0.218	0.002	0.044	-0.029	0.077	-0.033
Have Fever (12)	-0.073	0.102	0.044	-0.070	0.165	-0.034	-0.020
First 14 days (13)	-0.174	0.587	0.213	-0.120	0.102	0.316	-0.112
Smoked in Last Hour (14)	0.019	-0.077	0.112	0.263	0.116	-0.024	-0.014
Self-Report Stress (pre) (15)	0.108	0.008	0.024	0.048	0.020	0.026	0.047
Self-Report Stress (post) (16)	-0.026	-0.096	-0.006	0.134	0.001	0.028	-0.005
State Anxiety (pre) (17)	0.023	0.146	0.105	-0.036	0.087	0.072	0.015
State Anxiety (post) (18)	0.076	0.106	0.042	0.041	0.128	0.172	0.013
Trait Anxiety (pre) (19)	-0.011	0.182	0.090	0.091	0.151	0.038	-0.043
Perception of Status (20)	-0.106	-0.068	-0.099	0.012	-0.059	-0.053	-0.129

Table 8: Correlation matrix for variables 8-20 with 8-14

	8	9	10	11	12	13	14
Cortisol Response (1)							
Sex (2)							
Caffeine Today (3)							
Minutes Since Last Meal (4)							
Medication (5)							
On Birth Control (6)							
Exercise (7)							
Alcohol (8)	1.000						
Non-Prescription Drugs (9)	0.062	1.000					
Hours Slept Last Night (10)	0.079	0.107	1.000				
Typical Sleep Pattern (11)	-0.003	0.109	0.134	1.000			
Have Fever (12)	-0.028	-0.021	0.056	-0.019	1.000		
First 14 days (13)	-0.111	0.007	0.028	0.156	-0.064	1.000	
Smoked in Last Hour (14)	-0.020	-0.015	-0.101	0.062	-0.008	-0.045	1.000
Self-Report Stress (pre) (15)	0.057	0.021	-0.022	-0.030	-0.035	0.016	0.073
Self-Report Stress (post) (16)	-0.028	-0.019	-0.021	0.076	-0.079	-0.046	-0.002
State Anxiety (pre) (17)	-0.012	0.106	-0.070	-0.023	0.100	0.145	-0.026
State Anxiety (post) (18)	-0.047	0.064	-0.058	0.000	0.039	0.119	-0.014
Trait Anxiety (pre) (19)	-0.042	0.053	-0.067	-0.030	0.028	0.097	-0.033
Perception of Status (20)	-0.020	0.203	-0.066	0.130	0.010	-0.032	0.032

Table 9: Correlation matrix for variables 15-20 with 15-19

	15	16	17	18	19
Cortisol Response (1)					
Sex (2)					
Caffeine Today (3)					
Minutes Since Last Meal (4)					
Medication (5)					
On Birth Control (6)					
Exercise (7)					
Alcohol (8)					
Non-Prescription Drugs (9)					
Hours Slept Last Night (10)					
Typical Sleep Pattern (11)					
Have Fever (12)					
First 14 days (13)					
Smoked in Last Hour (14)					
Self-Report Stress (pre) (15)	1.000				
Self-Report Stress (post) (16)	0.491	1.000			
State Anxiety (pre) (17)	0.348	0.084	1.000		
State Anxiety (post) (18)	0.215	0.171	0.789	1.000	
Trait Anxiety (pre) (19)	0.189	0.076	0.607	0.536	1.000
Perception of Status (20)	0.075	0.111	-0.141	-0.212	-0.177

Experiment 1: Cortisol Response to Minority Status and Social Exclusion

The primary goal of Experiment 1 was to determine whether the type of structural and interactional environments encountered in the workplace by token women could cause a physiological stress response. To do this I constructed a social environment in a social science laboratory that roughly approximated these conditions. I then measured the cortisol response of participants exposed to these conditions in contrast to participants not exposed to these conditions.

To test for a difference in cortisol response between those exposed to the treatment and those exposed to the control, I regressed the measure of cortisol change on a dummy variable indicating whether the participant had been in the treatment or control group (Table 10).[28] I first add no controls to the regression and then I adjust for the team of confederates the participant had worked with, the semester the data was collected, as well as 11 controls measuring key biological factors known to cause variation in cortisol response (Dickerson and Kemeny 2004; Nicolson 2008).

[28] For Tables 10-11 the omitted Confederate Team dummy is Team 1. Also for Tables 10-11 for the semester dummy, "first semester, Fall 2007" = 1.

Table 10. Regression of Cortisol Response on Treatment

	Model 1	Model 2
	Treatment Only	Treatment and Controls
Main Effect		
Treatment	0.262**	0.272**
	(0.080)	(0.092)
Control Variables		
Confederate Team		
Confederate Team 2		0.018
		(0.127)
Confederate Team 3		-0.293
		(0.263)
Confederate Team 4		-0.224
		(0.256)
Semester		-0.292
		(0.254)
Caffeine Today		-0.041
		(0.100)
Minutes Since Last Meal		0.000
		(0.000)
Medication		-0.042
		(0.116)
On Birth Control		-0.055
		(0.174)
Exercise		0.187
		(0.312)
Alcohol		0.021
		(0.182)
Non-Prescription Drugs		0.115
		(0.225)
Hours Slept Last Night		-0.014
		(0.030)
Typical Sleep Pattern		0.082
		(0.093)

Table 10. Continued

Have Fever		-0.441
		(0.424)
First 14 Days		-0.134
		(0.112)
Intercept	-0.151**	0.211
	(0.056)	(0.336)
R^2	0.11	0.200
N	89	89

NOTE*:* Numbers in parentheses are robust standard errors.
*$p \leq .05$ * (two-tailed) $p \leq .01$ ** (two-tailed)*

Results indicate that participants subjected to gendered social exclusion and minority status had higher level of cortisol response than participants exposed to neither (b = .262, p ≤ .01) (Table 10, Model 1). Model 1 shows that treatment participants had a .262 nanomoles per liter (nmol/l) greater increase in cortisol from baseline after being exposed to gendered social exclusion and minority status than did control participants. In addition, this relationship remains strong and statistically significant when controls are added to the model (b = .272, p ≤ .01) (Table 10, Model 2). Model 2 shows that net of the relevant characteristics measured by the variables adjusted for, treatment participants had a .272 nmol/l greater increase in cortisol from baseline after being exposed to gendered social exclusion and minority status than did control participants. None of the controls have a statistically significant effect on the relationship between the treatment and cortisol response. Indeed the treatment effect is very similar whether the model includes controls or not (b = .262 vs. b = .272).

The controls for whether the participant was a woman on birth control or was a woman in the first 14 days of her menstrual cycle could act as a sort of control for sex[29] (because all men are coded as 0 on these two variables). However removing these controls from the model did not change the results in any meaningful way (analyses not shown). That is, the effect of the treatment on cortisol response was still statistically significant and in the predicted direction (b = .268, p ≤ .01). In sum, these results provide evidence that the types of social environments encountered by token women can cause a cortisol response, net of other factors.

[29] The models in Table 10 do not include a control for the sex of the participant because I was interested in first establishing whether there was an effect of the treatment for both women and men—before turning to sex differences in response. I address the question of the effect of the sex of the participant more fully in the following section titled: *Experiment 1: Cortisol Response to Minority Status and Gendered Social Exclusion, by Sex*. I find that sex is *not* a statistically significant predictor of cortisol response when all the controls are added and does not meaningfully change the relationship between cortisol response and treatment (analyses shown in Table 11).

Experiment 1: Cortisol Response over Time

Figure 7 is a basic graphic depiction of the relationship—over time in the laboratory setting— between cortisol response and whether the participant was subjected to minority status and gendered social exclusion, or not. This figure shows the mean level of cortisol response at each time point during the experiment, split by condition. The figure demonstrates that participants in the control group had a decreasing amount of cortisol over the course of the experiment. And, in contrast, participants in the treatment group show a marked increase in cortisol at fifteen minutes after the end of a ten-minute period of being socially excluded while being in the minority (that is at "Post-interaction 2").

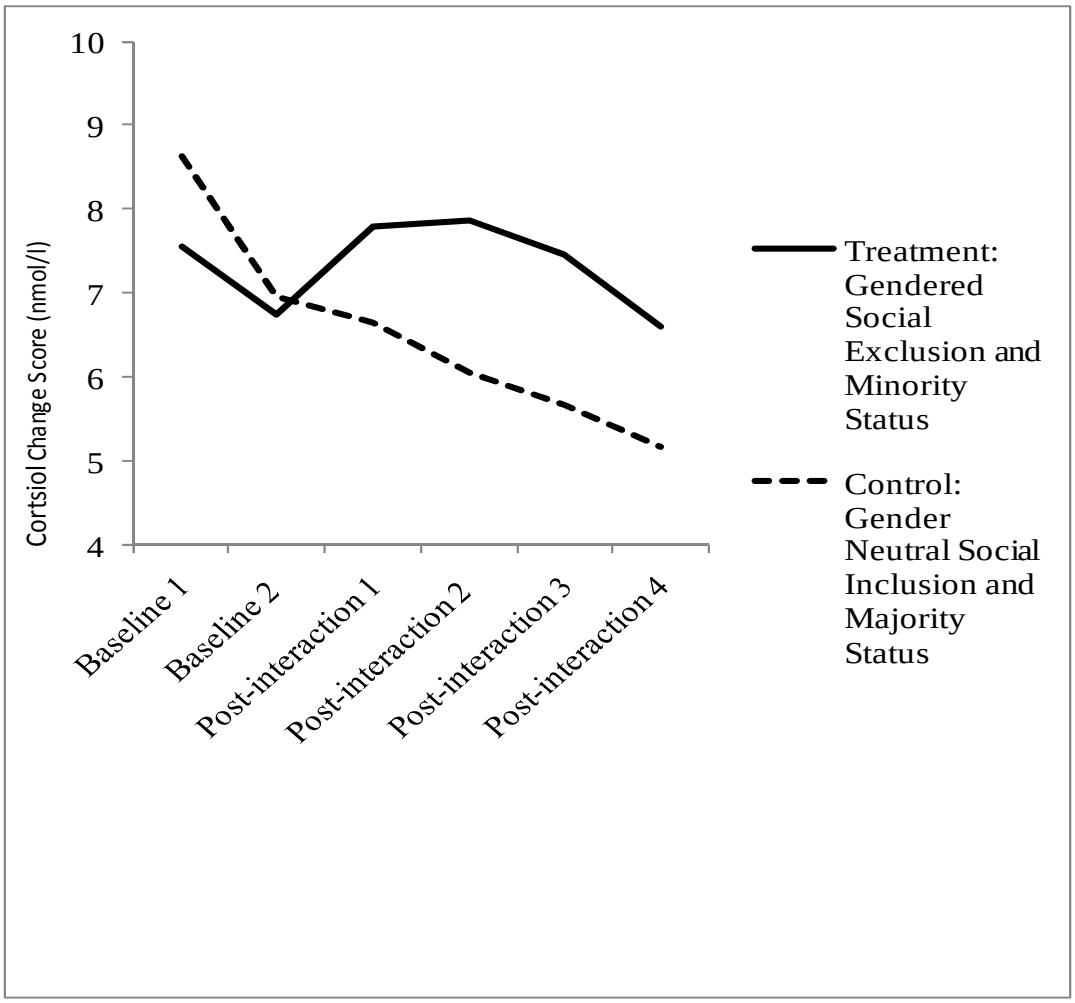

Figure 7: Experiment 1 - Effect of Minority Status and Gendered Social Exclusion on Mean Levels of Cortisol over Time (Full Sample)

The difference between the mean levels of cortisol in treatment and control subjects is not statistically significant using a two-tailed t-test at Baseline 1 nor Baseline 2 (Baseline 1 cortisol difference between control and treatment subjects: $t(87)=.34$, $p>.20$; Baseline 2 cortisol difference between control and treatment subjects: $t(87)=1.12$, $p>.20$). These analyses provide reasonable certainty that random

assignment was effective in that neither group had especially high or low levels of cortisol coming into the experiment.

Experiment 1: Response of Self Reported Measures of Stress and Anxiety

In order to better understand the relationship between self-report measures of stress response and a biological measure of stress response (cortisol) I conducted several analyses using self-report measures of stress and anxiety. In separate models I regressed the measure of self-reported, post-interaction stress and the measure of self-reported, post-interaction state anxiety on a dummy variable indicating whether the participant had been in the treatment or control group. Participants who were in the minority and exposed to gendered social exclusion do not have a statistically significantly higher level of self-reported stress after being subjected to the treatment than participants in the control group (with or without controls included in the model) (analyses not shown). In addition participants who were in the minority and exposed to gendered social exclusion do not have a statistically significantly higher level of state anxiety after being subjected to the treatment than participants in the control group (with or without controls included in the model) (analyses not shown).

I also conducted similar analyses using a change score for the measures of stress and anxiety, because a change score of these variables may a better comparison to the change score of cortisol response. Again participants who were in the minority and exposed to gendered social exclusion do not have a statistically significantly higher level of self-reported stress (using the change score as a measure of stress) after being subjected to the treatment than participants in the control group (with or without controls included in the model) (analyses not shown). However, participants who were in the minority and exposed to gendered social exclusion did evidence a

marginally statistically significantly higher level of state anxiety (using the change score as a measure of state anxiety; with or without controls included in the model). That is, these differences were significant at the $p \leq .10$ level but not at the $p \leq .05$ level (analyses not shown).

These analyses provide some evidence that a change in cortisol over time is likely co-occurring with a change in anxiety over time, when participants are exposed to gendered social exclusion. As such, the marginally significant level of change in anxiety provides some validation that cortisol is indeed measuring some level of anxious response to the treatment. However, the state-anxiety measure does not demonstrate as significant an effect as does cortisol. This discrepancy provides further evidence that a measurement of cortisol does detect a response to the treatment that cannot be reliably detected with self-report measures alone.

Experiment 1: Cortisol Response to Minority Status and Gendered Social Exclusion, by Sex

The central question addressed in Experiment 1 was whether participants would demonstrate a stress response to being in a laboratory setting with two of the social elements faced by token women in the workplace: gendered social exclusion and minority status on the dimension of sex. These analyses demonstrated that participants do have a statistically significant cortisol response to these conditions.

A second goal of Experiment 1 was to determine whether women or men had higher levels of cortisol response the types of structural and interactional environments encountered in the workplace by token women. To test for a sex difference in cortisol response in Experiment 1, I regressed the measure of cortisol change on sex (Table 11, Model 1) and then on sex and treatment (Table 11, Model 2). These two models show

that in Experiment 1, without adjusting for control variables, women evidence a statistically significantly lower level of cortisol response than men. In Model 3 I adjusted for treatment, the team of confederates the participant had worked with, the semester the data was collected, as well as 11 controls measuring biological factors known to cause variation in cortisol response. The effect of sex is no longer statistically significant when all controls are added into the model (Table 11, Model 3).[30] These analyses provide evidence that although women in this sample have a somewhat lower mean level of stress response (Table 11, Model 1), this sex difference is not robust to the addition of key controls (Table 11, Model 3).

[30] The lack of significance of sex in Model 3 does not seem to be attributable solely to the statistical power lost due to the addition of fifteen control variables. First, a robust effect of sex should remain even after controlling for these variables. For example, the effect of the combination of gendered social exclusion and minority status on cortisol response was robust to the addition of these fifteen controls (Table 10, Model 2). Second, various combinations of many fewer of these variables can also reduce the significance of sex substantially. For example, controlling only for confederate team, semester and whether the participant was on medication reduced the significance of sex to marginal. This is true of other combinations of control variables as well. In addition, it is not the effect of controlling for whether the participant was a woman who was on birth control or a woman in the first 14 days of her menstrual cycle that is reducing the effect of sex in these models. Removing the controls for either of these variables, or both of them simultaneously, still does not yield a significant effect of sex while all other controls are in the model. In addition, controlling only for these two variables does not yield a significant effect of sex.

Table 11. Regression of Cortisol Response on Treatment including Female

	Model 1	Model 2	Model 3
	Female Only	Treatment and Female	Treatment, Female and Controls
Main Effect			
Female	-0.203*	-0.178*	-0.122
	(0.082)	(0.079)	(0.116)
Treatment		0.244**	0.264**
		(0.079)	(0.092)
Control Variables			
Confederate Team			
Confederate Team 2			0.010
			(0.127)
Confederate Team 3			-0.255
			(0.265)
Confederate Team 4			-0.178
			(0.260)
Semester			-0.243
			(0.258)
Caffeine Today			-0.042
			(0.100)
Minutes Since Last Meal			0.000
			(0.000)
Medication			-0.039
			(0.116)
On Birth Control			-0.016
			(0.178)
Exercise			0.157
			(0.313)
Alcohol			0.021
			(0.182)
Non-Prescription Drugs			0.068
			(0.229)
Hours Slept Last Night			-0.013
			(0.030)
Typical Sleep Pattern			0.093
			(0.093)

Table 11. Continued

Have Fever			-0.386
			(0.427)
First 14 Days			-0.073
			(0.126)
Intercept	0.086	-0.048	0.205
	(0.060)	(0.071)	(0.336)
R^2	0.07	0.16	0.21
N	89	89	89

NOTE*:* Numbers in parentheses are robust standard errors.

*$p \leq .05$ * (two-tailed) $p \leq .01$ ** (two-tailed)*

I also regressed cortisol response on sex using a sample restricted only to those participants who had been subjected to minority status and gendered social exclusion (that is the treatment participants only). I executed two versions of this model—one with all controls added and one with none. In neither model is sex a statistically significant predictor of cortisol response (analyses not shown). These analyses provide further evidence that although participants evidenced a cortisol response to being in the minority and being socially excluded (see Table 10), that this response was not especially driven by one sex.

Taken together this set of analyses provides some support for the theoretical position of "deceptive distinctions" (Epstein 1988). That is, when women and men encounter similar social and structural environments, they have similar physiological responses. The somewhat lower level of cortisol response among women also provides weak evidence that higher status group members (that is, men with women) may be more response to threats to exclusion— which could be interpreted as threats to status—from lower status group members (that is, women) than lower status group members (women) are to threats from higher status group members.

Experiment 2: Cortisol Response to Minority Status Only

In the previous section I used the data collected in Experiment 1 to investigate two central questions. First, could the social conditions faced by token women cause a cortisol response in the laboratory? And second, would these conditions cause a cortisol response among both women and men? Experiment 1 provides evidence that the social conditions faced by token women can indeed cause a stress response and that when men are exposed to these conditions in the laboratory they will also exhibit a stress response.

One goal of Experiment 2 was to determine whether being in the minority alone could cause a cortisol response, using a similar experimental paradigm to that used in Experiment 1. A second goal of Experiment 2 was to further explore the status processes that cause cortisol response among token members of work groups. This second goal is addressed in Chapter 5. The first set of analyses (in the next section, below) address the question of whether being in the minority, but not being socially excluded, can cause a stress response similar to that documented in Experiment 1.

It is important to understand whether it is the composition of the group or the socially exclusionary behaviors that can cause a stress response, if workplace policy makers want to decrease the levels of distress encountered by token women. For example, the focus of workplace policy interventions may be different if policy makers are trying to address workplace sex composition versus equitable workplace social integration for men and women. Understanding which of these two factors is more likely to cause a stress response would be a useful first step in guiding development of workplace polices designed to assist and retain token women. The following models test whether being in the minority alone (without gendered social exclusion) can cause a cortisol reaction in a laboratory setting.

To test the differences in cortisol response between those exposed to being in the minority only[31] and those in the majority, I regressed the measure of cortisol change on a dummy variable indicating whether the participant had been in the treatment or control group in Experiment 2. Results from this model (Model 1, Table 12)[32] do *not* show a statistically significant effect of being in the minority

[31] That is those in the minority but *not* exposed to gendered social exclusion as was done in Experiment 1.

[32] For all subsequent tables which show controls for team dummies, the omitted Confederate Team dummy is Team 8. Also for subsequent tables which show controls a semester dummy, "first semester, Fall 2008" = 1. See footnote 27 for further notes on all tables in Chapters 4 and 5.

Table 12. Regression of Cortisol Response on Treatment

	Model 1 Treatment Only	Model 2 Treatment and Controls
Main Effect		
Treatment	0.145	0.277*
	(0.105)	(0.122)
Control Variables		
Confederate Team		
Confederate Team 9		0.423*
		(0.202)
Confederate Team 10		0.086
		(0.335)
Confederate Team 11		-0.130
		(0.259)
Confederate Team 12		-0.158
		(0.319)
Confederate Team 13		0.376
		(0.306)
Confederate Team 14		0.352
		(0.290)
Confederate Team 15		0.012
		(0.261)
Confederate Team 16		0.042
		(0.191)
Confederate Team 17		0.000
		(0.000)
Semester		-0.097
		(0.206)
Caffeine Today		-0.116
		(0.137)
Minutes Since Last Meal		0.000
		(0.000)
Medication		0.039
		(0.167)
On Birth Control		-0.293
		(0.319)
Exercise		0.182
		(0.289)

Table 12. Continued

Alcohol		-0.033
		(0.261)
Non-Prescription Drugs		-0.456
		(0.323)
Hours Slept Last Night		0.063
		(0.040)
Typical Sleep Pattern		-0.253*
		(0.122)
Have Fever		-0.703
		(0.577)
First 14 Days		-0.138
		(0.140)
Smoked in Last Hour		0.564
		(0.597)
Intercept	-0.065	-0.388
	(0.075)	(0.354)
R^2	0.02	.25
N	91	91

NOTE*:* Numbers in parentheses are robust standard errors.

NOTE: Confederate Team 17 dropped because of collinearity.

*$p \leq .05$ * (two-tailed) $p \leq .01$ ** (two-tailed)*

In Model 2, I adjusted for the team of confederates the participant had worked with, the semester the data was collected, as well as 12 controls measuring key biological factors known to cause variation in cortisol response.[33] Results indicate that participants experiencing minority status evidenced higher level of cortisol response than participants in the majority (b = .277, $p \leq .05$) (Table 12, Model 2). This shows that net of the relevant characteristics measured by the variables adjusted for, participants had a .277 nmol/l greater increase in cortisol from baseline after being exposed to minority status than did participants in the majority. These analyses provide evidence that the being in the minority and being included in a gender-neutral manner can cause a cortisol response. However, this cortisol response only emerges with standard controls added into the model.

In Model 2 the dummy variable indicating that the participant was working with Confederate Team 9 is a statistically significant predictor of cortisol response. One participant is driving the significance of this dummy variable. If I drop the participant with the highest change score of all the participants who worked with Team 9, then the dummy becomes non-significant (though the dummy does remain marginally significant) (analyses not shown). In addition, if I drop this participant from the analytic sample then the effect of the treatment on cortisol change is also reduced to marginal significance (b = .209, $p \leq .10$) (analyses not shown).

The participant who would be dropped in this case is a man who worked with a team of women confederates who did not subject him to gendered social exclusion (that is, he was a man in the treatment in Experiment 2). He has a change score of 2.04 nmol/l (the next highest change score among those participants working with this team

[33] I do not control for sex in these models because I am interested in the effect of the treatment without considering sex. I explore the question of sex differences in responsiveness to the treatment of being in the minority in the following section titled "*Experiment 2: Cortisol Response to Minority Only by Sex*".

is 1.45 nmol/l). This participant had some unusual circumstances in the laboratory. He did not speak English well and consequently had trouble understanding the experimenter's instructions at times and he mentioned that he was taking the Graduate Record Exam (GRE) in the next week and was feeling stress due to this. Either of these circumstances could have caused an unusually high level of stress response for this participant.

In sum minority status alone can cause a statistically significant cortisol response in this experimental scenario, but this response is not stable and robust to exclusion of controls as it is in Experiment 1. Nor is it robust to the exclusion of one highly responsive participant who is in the treatment condition and who worked with Confederate Team 9.

Experiment 2: The Effect of Control Variables in Model 2, Table 12

I did further analyses to establish whether one specific control variable or set of control variables is responsible for the larger and more significant effect of the treatment in Model 2 described above.[34] I was not able to establish one variable, or set of a few variables, that was solely responsible for the effect of the treatment on participants.

First I regressed cortisol response on the treatment adjusting only for the confederate team dummies and *not* the thirteen other control variables used in Model 2 of Table 12. In this model the treatment was not a statistically significant predictor of cortisol response. Second, I executed a series of thirteen similar models. In each model I regressed cortisol response on the treatment adjusting for the confederate team

[34] Analyses for this section are not shown.

dummies as well as each one of other thirteen control variables separately. So, for example first I regressed cortisol response on treatment adjusting for all of the confederate team dummies as well as which semester the participant was in. Then I executed a model in which I regressed cortisol response on treatment adjusting for all of the confederate team dummies as well as whether the participant had had caffeine that day. And so on, through all of the thirteen possible models. In none of these models was the treatment statistically significant.

Next I regressed cortisol response on the treatment adjusting for of the all control variables except the confederate team dummies. That is I adjusted for the thirteen variables listed in Table 12 from "Semester" to "Smoked in the Last Hour", and *not* for the confederate team dummies. When adjusting for all thirteen of these variables the treatment does have a significant effect on cortisol response. Fourth I regressed cortisol response on the treatment adjusting for all of the thirteen variables from "Semester" to "Smoked in the Last Hour" as well as the dummies for Confederate Teams 9 and 13. I chose this confederate team because it is the only statistically significant controls in Model 2. In this model, the treatment of being in the minority has a statistically significant effect on cortisol response.

In sum, it is not the controls for the team of confederates alone nor is it one of the other thirteen variables on its own that is causing a statistically significant relationship between the treatment and cortisol response. The model without the confederate dummies does evidence a statistically significant effect of treatment on cortisol. And the model with only the confederate dummy 9, plus all of the other thirteen control variables does evidence a statistically significant effect of treatment on cortisol. However, it does not make sense to run a model with only one of the team dummies. And, as shown in Model 2 of Table 12, adding the confederate dummies does make the effect of the treatment statistically significant. Over all then, it is the

full set of biological controls, with or without the team dummies, that allows an effect of the treatment to emerge in Model 2.

Experiment 2: Cortisol Response over Time

Figure 8 is a basic graphic depiction of the relationship—over time in the laboratory setting— between cortisol response and whether the participant was subjected to minority status or majority status. This figure shows the mean level of cortisol response at each time point during the experiment, split by condition. The figure demonstrates that participants in the treatment group had a somewhat higher cortisol response about 15 minutes after the end of a ten minute period of being socially excluded while being in the minority (that is at "Post-interaction 2"). However, this response is not markedly different from the response in the control group. Both groups mostly decrease in cortisol response over time.

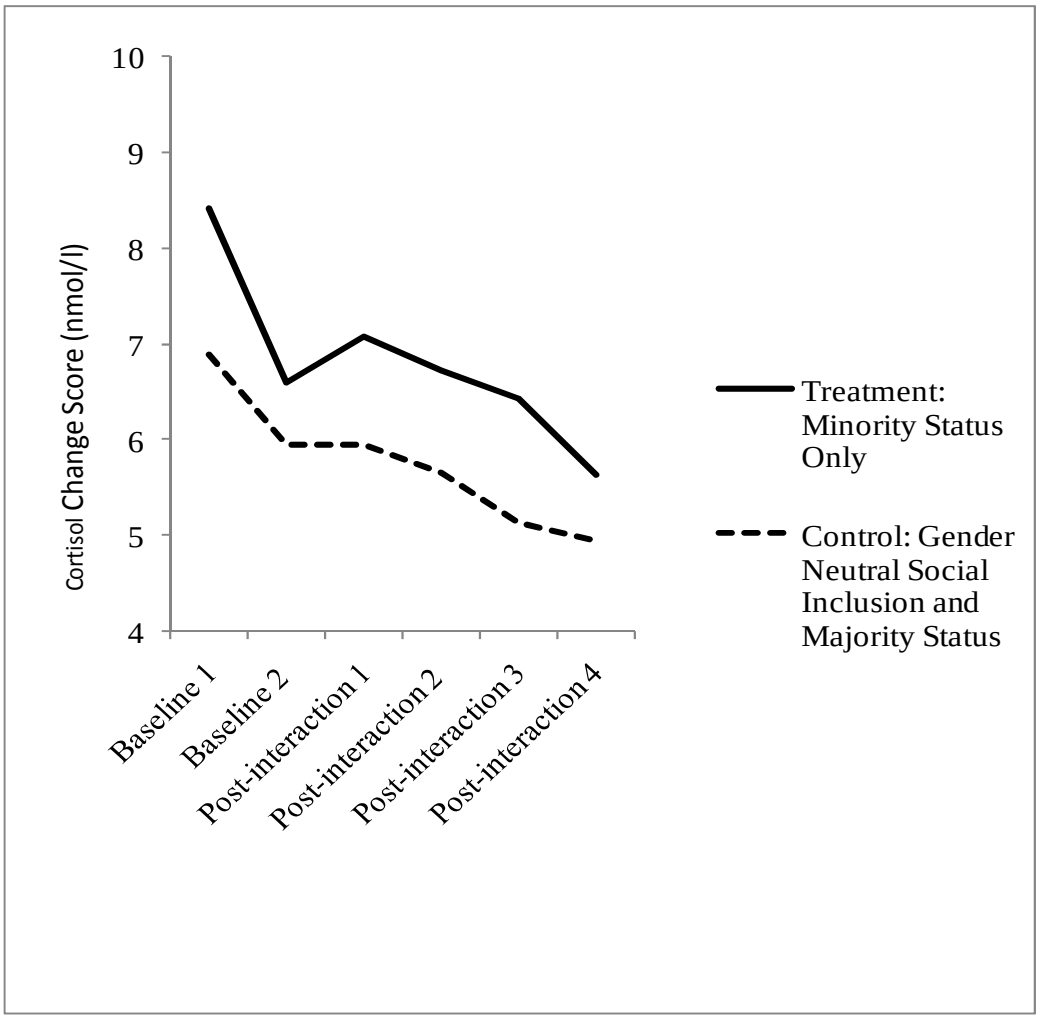

Figure 8: Experiment 2 - Effect of Minority Status Only on Mean Levels of Cortisol over Time (Full Sample)

The difference between the mean levels of cortisol in treatment and control participants is not statistically significant using a two-tailed t-test at Baseline 1 nor Baseline 2 (Baseline 1 cortisol differences between control and treatment subjects:

$t(90)=-1.64$, $p>.10$; Baseline 2 cortisol differences between control and treatment subjects: $t(90)=-.90$, $p>.10$). These analyses provide reasonable certainty that random assignment was effective in that neither group had especially high or low levels of cortisol coming into the experiment.

Experiment 2: Response of Self Reported Measures of Stress and Anxiety

I also conducted several analyses using self-report measures of stress and anxiety. Once again, I was interested in whether subjective measures of stress and anxiety could measure the physiological stress response measured by cortisol response. In separate models I regressed the measure of self-reported, post-interaction stress and the measure of self-reported, post-interaction state anxiety on a dummy variable indicating whether the participant had been in the treatment or control group. Participants who were in the minority do not have a statistically significantly higher level of self-reported stress after being subjected to the treatment than participants in the control group (with or without controls included in the model) (analyses not shown). In addition participants who were in the minority do not have a statistically significant higher level of state anxiety after being subjected to the treatment than participants in the control group (with or without controls included in the model) (analyses not shown). Using a change score yielded virtually the same results. That is, the neither the change score for self-reported stress nor for self-reported anxiety demonstrated a statistically significant response to the treatment (with or without controls) (analyses not shown).

In summary then the combined analyses of the subjective measures of stress response and anxiety from Experiments 1 and 2 provide evidence that cortisol may be able to document a stress response that is not reliably measured by subjective

appraisals of stress and anxiety. I utilized a measure of cortisol response as well as self-report measures of stress, and the data do not provide a consistently converging pattern. The only instance in which a statistically significant cortisol response is similar to a self-report response is when the change score for state-anxiety is regressed on the treatment in Experiment 1. In this case, participants in the treatment group report a marginally significant ($p \leq .10$) increase in anxiety (as compared to the control group) after being exposed to gendered social exclusion while in the minority. This general lack of consistency in self-report measures of stress and anxiety (when compared to cortisol response) provides evidence that the stress response in these experiments was not captured fully by subjective measures of stress and anxiety. This finding is important because it would be unnecessarily time and resource consuming to measure cortisol response to a social stressor if subjective measures of stress or anxiety worked equally well to demonstrate stress response.

Nevertheless the lack of correlation between subjective and physiological measures of stress response should be interpreted cautiously. The subjective measure of stress response utilized in this study is modified from the "Perceived Stress Scale" (Cohen, Kamarck, and Mermelstein 1983). The original perceived stress scale is meant to be used to document a global measure of perceived stress in general (that is, not a measure of stress in that exact moment). Thus it is not the ideal measure of current or state level of stress response, as I used it in this study. In addition, the change score based on the STAI (a well-validated and widely used measure of current level of anxiety (Spielberger, Gorsuch and Lushene 1983)) did evidence a marginal response to being in the minority and being subjected to gendered social exclusion.

Despite these limitations however, my results are similar to previous literature which demonstrates a lack of converge between subjective and biological measures of stress and anxiety laboratory studies using a variety of measures of subjective stress

and distress (Nicolson 2008). In addition though the measure of stress is not ideal it does contain items asking directly about perceived levels of stress, control, irritation and level of nervousness. These are items which can be reasonably expected to pick up current levels of subjective stress response. Furthermore, though the validated measure of state anxiety did evidence a marginally significant response in some instances where cortisol was statistically significant (Experiment 1), it did not evidence any response at all in other instances where cortisol was responsive (adjusted model in Experiment 2). In sum, despite the limitations of my subjective measure of stress, and some response in the change score measuring state anxiety, there is good evidence that in collecting cortisol I measured a level of stress response that could not be measured with subjective measures of stress response alone.

Experiment 2: Cortisol Response to Minority Only by Sex

In the previous sections I demonstrate that participants exhibit some cortisol response to being in the minority in a working group, even they are not being socially excluded. In these analyses, this response only emerges in the models in which controls are added. However, in these models I did not add a control for the sex of the participant. In the following section I investigate how the sex of the participant impacts the effect of minority status on cortisol response.

In order to explore the effect of sex, I first regressed cortisol response on a dummy variable for whether the participant was a man or a woman (female = 1) while adjusting for sex (Model 1, Table 13). Model 1 shows that with no adjustments for other variables, women had a .299 nmol/l lower cortisol response to being a participant in Experiment 2 than did men (b = -.299, $p \leq .01$).

Table 13. Regression of Cortisol Response on Sex, Treatment

	Model 1	Model 2
	Female Only	Treatment and Female
Main Effect		
Female	-0.299**	-0.304**
	(0.101)	(0.101)
Treatment		0.155
		(0.101)
Treatment × Female		
Intercept	0.159*	0.084
	(0.072)	(0.087)
R^2	0.09	0.11
N	91	91

NOTE*:* Numbers in parentheses are robust standard errors.

*$p \leq .05$ * (two-tailed) $p \leq .01$ ** (two-tailed)*

In Model 2 I regressed cortisol on the female dummy variable and the treatment dummy variable. In this model treatment is not a statistically significant predictor of cortisol response, but the sex of the participant remains a significant and negative predictor of cortisol response (b = -.304, $p \leq .01$). This finding is especially relevant because in Experiment 2, there is a statistically significant difference in response to the treatment of minority status alone when sex is not adjusted for (Table 12, Model 2). However, when the model is adjusted for whether the participant is a woman, the effect of the treatment loses its statistical significance (Table 13, Model 2).

Next, in Table 14 (Model 1), I regressed cortisol on the female dummy and the treatment dummy, adjusting for the thirteen key control variables used in previous models. In Model 1 (Table 14) sex becomes marginally significant. In addition the effect of the treatment becomes statistically significant again. The loss of the

significance of sex can be accounted for by the inclusion of the variable that indicates whether the participant is a woman in the first 14 days of her menstrual cycle. The inclusion of this variable removes the effect of the sex of the participant because it is highly co-linear with sex (the first-order correlation between sex and the dummy for whether the participant is a woman in the first 14 days of her menstrual cycle is .59). In addition, the statistical significance of the treatment (which was not evident in previous models controlling for sex, but not for the 13 other controls) can be attributed to the addition of the controls for: 1) whether the participant had had caffeine that day, 2) whether the participant had consumed any non-prescription drugs in the last 24 hours and 3) whether the participant had had a typical night's sleep the night before. Removing only these three controls (and the control for whether the participant is a woman in the first 14 days of her menstrual cycle) from the analyses in Model 1 restores the negative and statistically significant effect of the sex of the participant and the non-significant effect of treatment (analyses not shown). In sum, in Models 1 and 2 of Table 13 and Model 1 of Table 14 the relationship between sex, treatment and the control variables is not clear.

Table 14. Regression of Cortisol Response on Sex, Treatment and Sex × Treatment Interaction

	Model 1	Model 2
	Treatment, Female and Controls	Treatment, Female, Controls and Treatment × Female
Main Effect		
Female	-0.284	-0.081
	(0.144)	(0.171)
Treatment	0.235*	0.480**
	(0.114)	(0.162)
Treatment × Female		-0.473*
		(0.226)
Control Variables		
Semester	0.005	-0.023
	(0.116)	(0.114)
Caffeine Today	-0.089	-0.133
	(0.127)	(0.126)
Minutes Since Last Meal	0.000	0.000
	(0.000)	(0.000)
Medication	0.046	0.073
	(0.150)	(0.147)
On Birth Control	-0.212	-0.175
	(0.294)	(0.288)
Exercise	0.083	0.177
	(0.273)	(0.271)
Alcohol	-0.139	-0.086
	(0.235)	(0.231)
Non-Prescription Drugs	-0.650*	-0.689*
	(0.315)	(0.309)
Hours Slept Last Night	0.029	0.029
	(0.037)	(0.036)
Typical Sleep Pattern	-0.103	-0.156
	(0.117)	(0.117)
Have Fever	-0.388	-0.275
	(0.560)	(0.550)
First 14 Days	-0.032	0.052
	(0.162)	(0.164)

Table 14. Continued

Smoked in Last Hour	0.220	0.401
	(0.582)	(0.576)
Intercept	-0.059	-0.132
	(0.298)	(0.294)
R^2	0.19	0.24
N	91	91

NOTE*:* Numbers in parentheses are robust standard errors.

NOTE: I do not control for confederate teams in these models because teams are perfectly collinear with the sex × treatment interaction term and will cause the sex × treatment interaction term to drop from the model.

*$p \leq .05$ * (two-tailed) $p \leq .01$ ** (two-tailed)*

I looked at the relationship between sex and treatment in Model 2 of Table 14, in order to better understand the inconsistent effects of treatment and sex in Table 13 and Model 1 of Table 14. In Model 2 (Table 14) I regressed cortisol on the female dummy variable, the treatment dummy variable, and an interaction between sex and treatment while adjusting for the thirteen key variables. In this model there is a statistically significant interaction between sex and treatment (Table 14, Model 2).

The coefficient associated with the interaction term between treatment and sex indicates that there is a statistically significant difference between men and women in responsiveness to whether he or she is in the treatment group (b = -.473, $p \leq .05$). The negative sign associated with this interaction term (-.473) indicates that women had a lower cortisol response in Experiment 2 than did men, and that this is especially true in the treatment group. That is, the sex difference in cortisol responsiveness modeled by the interaction term in Model 2 (Table 14) occurs exclusively in the treatment group. Specifically, in the treatment group, men are highly responsive in comparison to women.[35] Men have a higher cortisol response to being the only man in a group of women who are not socially excluding him than do women to being the only woman in a group of men who are not socially excluding her. In contrast, neither women nor men exhibit a cortisol response to being in a group of the same sex who are not socially excluding him or her.

The relationship modeled in Model 2, Table 14 is depicted in Figure 9. This figure shows the mean levels of cortisol response for women and for men, in both the treatment and control groups.[36] The black bars in Figure 9 depict participants who were in the treatment group. The black bar on the left depicts the cortisol response of

[35] I performed several tests in order to determine whether this sex difference in responsiveness in the treatment group is robust. The difference in cortisol reaction between women and men cannot be explained by an outlier or by exposure to one specific confederate (analyses not shown).

[36] These means were computed adjusting for all of the control variables included in Model 2, Table 14.

women who are in the minority and the black bar on the right depicts the cortisol response of men who are in the minority. In contrast, in the control group (depicted by gray bars) there is virtually no sex difference in cortisol response. Among participants majority and not socially excluded, women and men have virtually the same negative cortisol response. Figure 9 demonstrates that men have higher cortisol response to being in the minority and not being socially excluded than do women. At the same time, women and men are virtually identically responsive to being in majority and not being socially excluded.

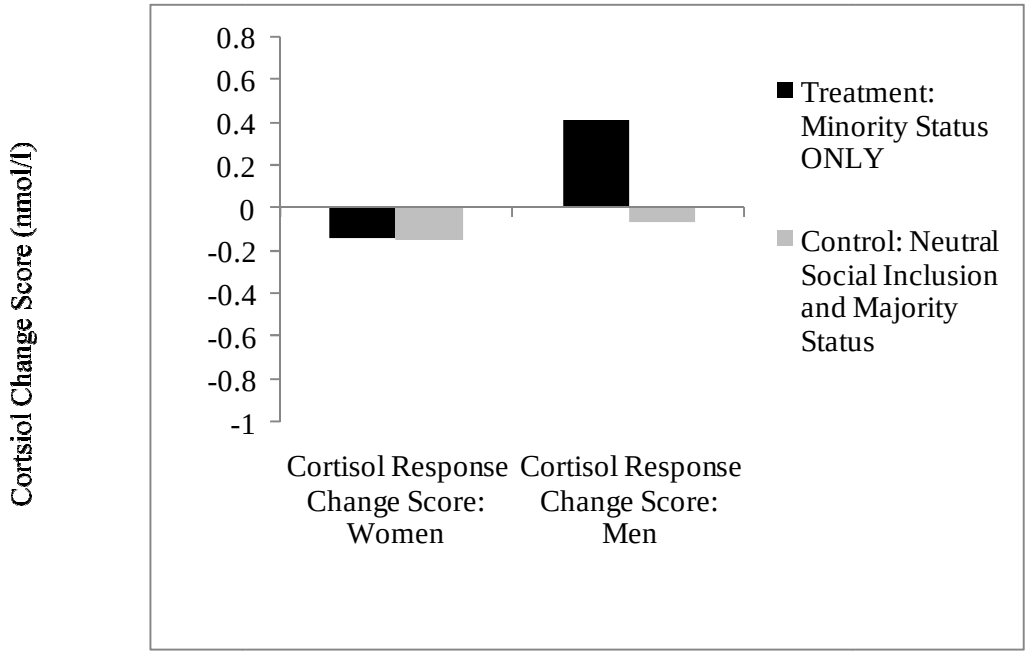

Figure 9: Experiment 2 - Effect of Minority Status Only on Mean Levels of Cortisol, by Sex

In Chapter 2 I hypothesized that men might be especially responsive to self-

perceptions of threats to status when in a group of women because they expect to be treated as high status by the women. On the other had I also suggest that women might be especially responsive to being in the minority in a group of men because their relatively low status is being made salient. The treatment group in Experiment 2 provides an opportunity to compare the validity of these competing hypotheses. Among participants were in the minority but were treated relatively neutrally socially, a cortisol response to these social processes might emerge.

The findings from the participants in the treatment in Experiment 2 indicate that men were in fact highly responsive to being in the minority and being socially included and the women were not. This provides evidence that having a low value on a status characteristic and having that value be made salient by being in the minority (but *not* being socially excluded as token women often are) in a mixed sex group did not evoke a cortisol response for these women. However, it does not necessarily provide evidence that men are especially responsive in this condition *because* they are especially responsive to self-perceptions of threats to status when in a group of women—because they expect to be treated as high status by those women. In order to test this specific mechanism of expectations and perceptions of status as a stressor, I utilize a measure of self-perception of status in Chapter 5. In addition I use two different types of status characteristics to determine if this hypothesized effect of perceived status can be generalized to other status groups. I test the relationship between perceived status and cortisol response among college seniors (a group with a high value of a status characteristic) as well as among ethnic minorities (a group with a low value of a status characteristic).

CHAPTER 5

STUDY 2: CORTSIOL RESPONSE TO PERCEPTIONS OF STATUS

Previous work has demonstrated that token women have negative social experiences in the workplace (see box on the top left of Figure 1). In Chapter 3 I provide evidence that women who are in the minority at the occupational level also perceive negative social experiences in the workplace (see box in the top, middle of Figure 1). In Chapter 4 I provide evidence that the type of social environments encountered by token women can cause a cortisol response among both women and men (see box on the top right of Figure 1). I also provide evidence that the combination of both being in the minority and being exposed to gendered social exclusion causes a more consistent stress response than minority status alone (see box on lower left of Figure 1). I assert—based on previous work on cortisol response—that the some of the effects of gendered social conditions on cortisol response can be understood by examining perceptions of status in the group (see box on lower right of Figure 1). This should be especially true in the case of participants who are not being socially excluded in a gendered manner. This relatively neutral social environment should allow the effects of perceptions of status on cortisol response to emerge.

It is important to understand status processes as a part of the experience of occupational minority women and men as well as token women and men because gendered status processes in the workplace can be implicated in the creation and reproduction of social workplace environments (Ridgeway 1997). And more generally status processes are an important part of the gendered system of social relations (Ridgeway and Correll 2004).

In this chapter I focus on two questions related to the effects of perceptions of status (see box on lower right of Figure 1). First, is the sex difference in cortisol

response (among participants who are in the minority and socially included) due men's higher level of response to a perception of being seen as low status by the opposite sex? Second, does this principle generalize to other groups? That is, are other high status actors (for example, college seniors and men) more likely to have a cortisol response to being seen as low status by low status group members (for example, underclassmen and women)? And are other low status actors (for example women and ethnic minorities) likely to have a minimal cortisol response to a perception of being seen as low status by high status group members (for example men or white students)? If this principle does generalize to other status groups then this provides evidence that status processes are at work in sex differences evidenced in Experiment 2. I conduct several analyses to examine these questions.

Sex Differences in Cortisol Response to Perceived Status among Tokens who are Socially Included

In this section I focus on the first of the two questions presented above. That is, is the sex difference in cortisol response in the treatment condition[37] in Experiment 2 due men's higher level of response to a perception of being seen as low status by the opposite sex? The measure of perceived status that I use to address this question is an index made up of two variables: 1) "people in this group probably think highly of me" and 2) "I felt like I was a natural leader for the group". Both questions were asked of participants after they had interacted with the small group. I expect that participants who are tokens and who are socially included will be responsive to their subjective perceptions of their status in the group. In addition, I expect that men will be

[37] See Tables 13 and 14, as well as Figure 9.

especially responsive to a low subjective level of group status when working with a group of women—in comparison to a woman working with a group of men.

In order to test whether perception of status is an important predictor of cortisol response among participants in the minority in a workgroup, I first executed two models with different measures of the perceived status variable (Table 15). In Model 1, I regressed cortisol response on the variable for "think highly of me", adjusting for sex, confederate team and twelve other key control variables.[38] This item alone is not a statistically significant predictor of cortisol response. In Model 2, I regressed cortisol response on the variable for "natural leader". This item alone does predict cortisol response (b = -0.231, $p \leq .01$). Among participants who were in the minority by sex and exposed to gender neutral social inclusion there is a positive cortisol response to thinking that one is not seen as a natural leader of the group.

[38] I dropped the "smoked in the last hour" variable from the models in Tables 15 and 16 because no participants in the treatment in Experiment 2 reported having smoked in the last hour.

Table 15. Regression of Cortisol Response on Perceived Level of Status in Group (Participants in Treatment in Experiment 2 Only)

	Model 1 Think Highly Only	Model 2 Natural Leader Only
Main Effect		
Think Highly	-0.161	
	(0.142)	
Natural Leader		-0.231**
		(0.073)
Control Variables		
Female	-0.601	-0.751
	(0.474)	(0.405)
Confederate Team		
Confederate Team 9	0.897*	0.684*
	(0.373)	(0.325)
Confederate Team 10	0.517	0.255
	(0.419)	(0.368)
Confederate Team 11	-0.077	-0.194
	(0.365)	(0.317)
Confederate Team 12	-0.130	-0.156
	(0.427)	(0.362)
Confederate Team 13	0.000	0.000
	(0.000)	(0.000)
Confederate Team 14	0.265	0.100
	(0.422)	(0.358)
Confederate Team 15	-0.066	-0.489
	(0.430)	(0.399)
Confederate Team 16	0.160	0.129
	(0.497)	(0.406)
Confederate Team 17	0.000	0.000
	(0.000)	(0.000)
Semester	0.014	0.251
	(0.390)	(0.337)
Caffeine Today	-0.158	-0.145
	(0.156)	(0.133)

Table 15. Continued

Minutes Since Last Meal	-0.000	-0.000
	(0.000)	(0.000)
Medication	-0.292	-0.193
	(0.292)	(0.240)
On Birth Control	0.254	0.384
	(0.404)	(0.341)
Exercise	0.597	0.383
	(0.473)	(0.404)
Alcohol	0.169	0.129
	(0.286)	(0.247)
Non-Prescription Drugs	-0.328	0.013
	(0.382)	(0.350)
Hours Slept Last Night	-0.011	-0.004
	(0.059)	(0.050)
Typical Sleep Pattern	-0.002	0.035
	(0.171)	(0.145)
Have Fever	0.425	0.441
	(0.623)	(0.534)
First 14 Days	0.394	0.362
	(0.276)	(0.236)
Intercept	0.800	0.996*
	(0.649)	(0.466)
R^2	0.66	0.74
N	46	46

NOTE*:* Numbers in parentheses are robust standard errors.

NOTE: Confederate Teams 13 and 17 dropped because of collinearity.

*$p \leq .05$ * (two-tailed) $p \leq .01$ ** (two-tailed)*

This trend is replicated and strengthened when I regress cortisol response on the two-item perceived status index (b = -.384, $p \leq .01$) (Table 16, Model 1). Among participants who were in the minority by sex and exposed to gender-neutral social inclusion there is a positive cortisol response to perceptions of low status in the group. And participants who have a high level of cortisol response tend to report they do not feel that they had high status in the group. Specifically, participants report an average of .384 nmol/l more cortisol change over the course of the experiment for every one-unit decrease on the perceived status scale. In other words, on average, when a person perceives a higher level of status he or she exhibits a lower cortisol response. In contrast, the perceived status index is not associated with cortisol response in any of the other subgroups in the two experiments at a statistically significant level, with or without the control variables added (that is, in Experiment 1: neither in treatment nor control participants and Experiment 2: not in control participants; analyses not shown).

Table 16. Regression of Cortisol Response on Perceived Level of Status in Group (Participants in Treatment in Experiment 2 Only), With Interaction with Sex

	Model 1	Model 2
	Perceived Status	Perceived Status X Sex Interaction
Main Effect		
Perceived Status: Mean of "Think Highly" and "Natural Leader"	-0.384**	-0.585**
	(0.118)	(0.194)
Perceived Status X Sex Interaction		0.323
		(0.247)
Control Variables		
Female	-0.874*	-2.183
	(0.412)	(1.083)
Confederate Team		
Confederate Team 9	0.593	0.354
	(0.332)	(0.375)
Confederate Team 10	0.336	0.350
	(0.361)	(0.356)
Confederate Team 11	-0.174	-0.139
	(0.314)	(0.311)
Confederate Team 12	-0.260	-0.178
	(0.364)	(0.364)
Confederate Team 13	0.000	0.000
	(0.000)	(0.000)
Confederate Team 14	-0.034	-0.257
	(0.369)	(0.402)
Confederate Team 15	-0.477	-0.712
	(0.393)	(0.427)
Confederate Team 16	0.332	0.643
	(0.415)	(0.474)
Confederate Team 17	0.000	0.000
	(0.000)	(0.000)
Semester	0.380	0.645
	(0.351)	(0.401)

Table 16. Continued

Caffeine Today	-0.174	-0.159
	(0.133)	(0.131)
Minutes Since Last Meal	-0.000	-0.000
	(0.000)	(0.000)
Medication	-0.313	-0.237
	(0.241)	(0.245)
On Birth Control	0.519	0.353
	(0.351)	(0.369)
Exercise	0.513	0.503
	(0.399)	(0.394)
Alcohol	0.111	0.132
	(0.246)	(0.243)
Non-Prescription Drugs	0.001	0.199
	(0.345)	(0.373)
Hours Slept Last Night	-0.009	-0.012
	(0.050)	(0.049)
Typical Sleep Pattern	0.078	0.042
	(0.147)	(0.148)
Have Fever	0.538	0.442
	(0.532)	(0.530)
First 14 Days	0.404	0.380
	(0.235)	(0.232)
Intercept	1.476*	2.135**
	(0.546)	(0.738)
R^2	0.75	0.76
N	46	46

NOTE*:* Numbers in parentheses are robust standard errors.

NOTE: Confederate Teams 13 and 17 dropped because of collinearity.

*$p \leq .05$ * (two-tailed) $p \leq .01$ ** (two-tailed)*

In Chapter 2 I hypothesize that there should be sex differences in participants' responsiveness to perceived status in the group in which participants are in the minority but not subjected to gendered social exclusion (that is, the treatment group in Experiment 1). I argue that men should be more responsive to a subjective perception that they are seen as low status by a group of women than women will be to a subjective perception that they will be seen as low status by a group of men. In order to test this hypothesis I regressed cortisol response on the two-item perceived status index as well as an interaction term for sex and perception of status (Model 2, Table 16). I do not find a statistically significant interaction between perceived status and sex (in relation to cortisol response) among the participants who were in the minority only ($b = .323$, $p > .05$). This indicates that though in general women and men both have a cortisol response to a perception of being seen as low status, there is not a statistically significant difference in their level of cortisol response.

However, despite this lack of statistical significance, I argue that there is some evidence that men are especially responsive to their perception of status in this condition—when their perception of status is low. In order to illustrate this I computed the mean level of cortisol response at each level of percieved status, split by sex (Figure 10).[39] Figure 10 provides some reason to believe that men and women responded differently to a low perception of status. First, the level of cortsiol response is quite different for women and for men when participants perceive their level of perceived staus in the group to be lower (for example between 2 and 3 out of 5; see far left side Figure 10). In this case, men have a much higher cortisol response than women. In contrast, the level of cortisol response is similar for women and men when participants perceived their level of status in the group to be high (for example 4.5 out of 5; see far right side of Figure 10).

[39] These means were computed adjusting for all of the control variables included in Model 2, Table 16.

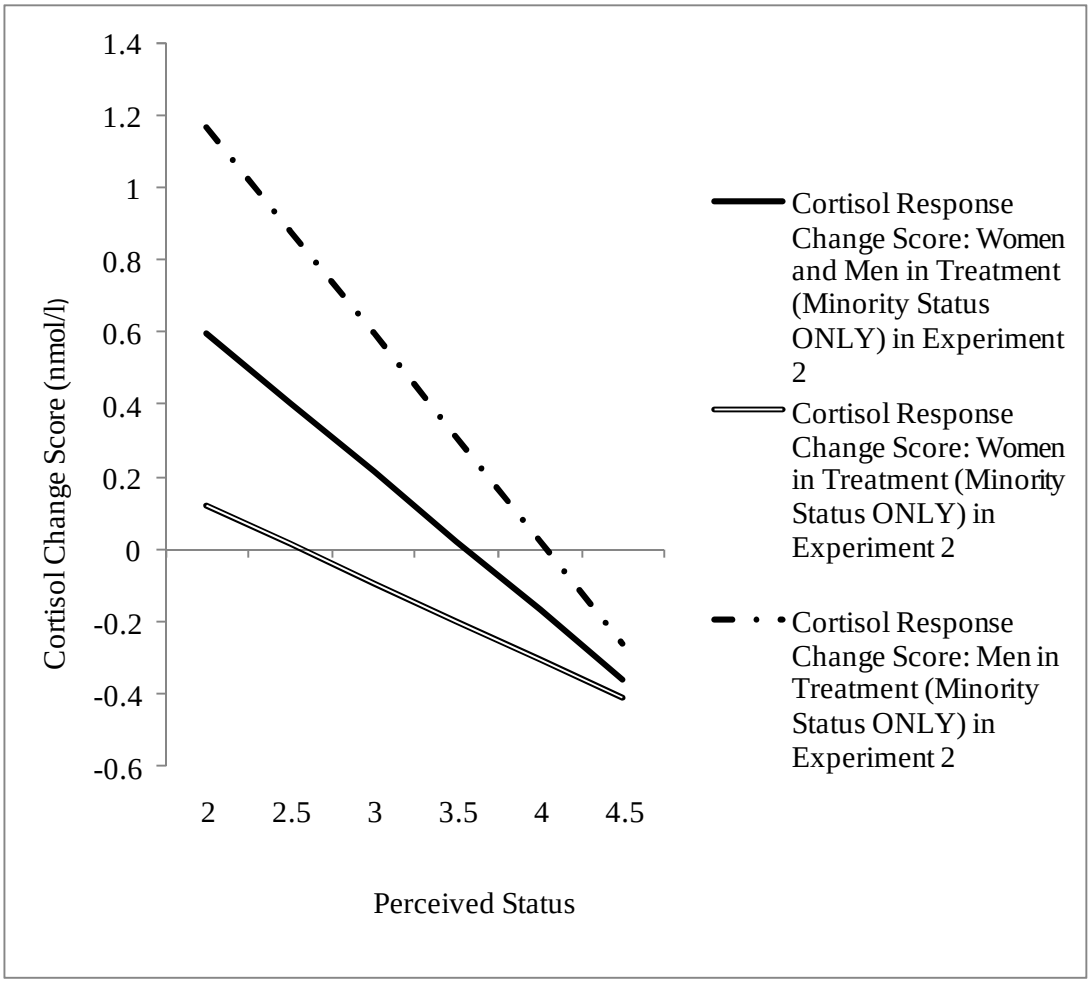

Figure 10: Experiment 2, Treatment Only - Effect of Perceived Status in the Group with all Controls in the Model, by Sex

It is also the case that women (the bottom line on the figure) have a much flatter slope representing their response to perceptions of status than do men (the top line on the figure). In fact women's response to perceptions of status hover around zero—ranging from very low (less than .2 nmol/l when they see themselves as very low status) to decreasing to slightly below zero (when they see themselves as high

status). Men on the other hand respond at around 1.3 nmol/l when they see themselves as very low status, creating a steeper slope for men than for women. In sum, there is a suggestion of a meaningful sex difference in response to seeing oneself as low status in a group comprising opposite sex members—though there is not a statistically significant interaction between sex and perceptions of status. Perhaps with a larger sample size this difference would reach statistical significance.

These findings provides some support for the assertion that the cortsiol response of token men who are not socially excluded is dependent on the men's subjective perceptions of their status in the group. This evidence also provides some support for the more general thereotical argument that a perceived status threat to a high-status actor (man) by lower-status actors (women) causes more of a cortisol reaction than the converse. That is, a perceived status threat to a low-status actor (woman) by higher status actors (men) provokes a minimal cortisol response.

Further support for this finding comes from additional analyses I was able to perform using these data. First I wanted to test the proposition that higher status actors would be more responsive to perceptions of threats to status from lower status actors—than would lower status actors to threats from higher status actors. I argue that a perceived disruption of a taken-for-granted status order should be especially likely to cause a cortisol response from high status actors. Second, I wanted to test the proposition that low status actors would be relatively unresponsive to perceptions of threats to status from higher status actors. I argue that for members of groups which are perceived to be lower status, there will be an expectation of being treated as low status and therefore perceptions of being seen as low status will not cause a cortisol response.[40]

[40] In groups with a lower value on a status characteristic encountering a negative social environment might indeed cause a cortisol response. For example, as outlined in Chapter 2, experiencing racism or homophobia could cause a cortisol response. However, in this scenario I am trying to determine how

In the two experiments there were two groups which I used to examine these questions. I choose groups which had either a low value or a high value on a status characteristic—relative to the confederates. The group with the high value on the status characteristic is college seniors. Education is a status characteristic—with more educated people being treated as higher status than less educated people. And in a traditional four-year university such as Cornell seniors are seen as higher status than younger cohorts. The group with a low value on the status characteristic—that I use in this section—is African-Americans and Latinos. Race or ethnicity can also be a status characteristic with people of color (especially African-Americans and Latinos) being seen as lower status than whites.

Cortisol Response to Perceived Status among College Seniors

The analyses involving colleges seniors were used to determine whether other groups with a high value of a status characteristic would be responsive to low levels of perceived status in a work group (as were men in the treatment in Experiment 1). All of the groups of confederates had 0-1 college seniors in them.[41] Thus a senior participant working with a group of confederates would either be working in a group of others who all had a lower value on a status characteristic or in a mixed-group. I measured whether participants who were seniors were more responsive to a perception of being seen as low status than participants who were not seniors. I expected that

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variations in perceptions of status might have less of an impact on actors with low values of a status characteristic than on those with a high value of a status characteristic—especially in a scenario in which that specific status characteristic is *not* being made salient through social phenomena such as racism (in the case of African-Americans for instance).

[41] The cohort composition of the group was known to the confederate almost immediately. The script directed the confederates to start the conversation off with the topic of what year the students were at Cornell.

seniors would be more responsive to a perception that they are seen as low status because they would perceive that their taken-for-granted high status was being threatened—similar to the comparison between women and men in the previous analyses. In this case seniors would be analogous to men and non-seniors would be analogous to women.

In order to test this assertion I examined several models using the full analytic sample from both experiments.[42] First I regressed cortisol response on a dummy variable for whether the participant was a senior or not (Table 17, Model 1). In Models 2 and 3 (Table 17) I regressed cortisol response on perceived status alone and then on perceived status and the "senior" dummy variable. In none of these models are these variables statistically significant predictors of cortisol response.

[42] I used the full sample for the analyses concerning race/ethnicity and cohort (that is, whether the participant was a senior or not) because the confederates did not make race/ethnicity nor cohort salient in the conversation. Thus all participants were exposed to a relatively neutral and ambiguous social condition in terms of race/ethnicity and cohort. It is in these relatively ambiguous social settings that I expect the effects of perceptions of status in the group to be especially important to cortisol response.

Table 17. Regression of Cortisol Response on Perceived Level of Status in Group Among Seniors (Experiments 1 and 2)

	Model 1	Model 2	Model 3
	Senior	Perceived Status	Senior and Perceived Status
Main Effect			
Senior (Senior = 1)	0.152		0.144
	(0.084)		(0.084)
Perceived Status		-0.086	-0.082
		(0.046)	(0.045)
Intercept	-0.037	0.268	0.225
	(0.038)	(0.149)	(0.150)
R^2	0.02	0.02	0.04
N	180	180	180

NOTE*:* Numbers in parentheses are robust standard errors.

*$p \leq .05$ * (two-tailed) $p \leq .01$ ** (two-tailed)*

In Table 18 (Model 1) I regressed cortisol response on perceived status and the "senior" dummy variable, including a control for sex as well as the 12 biological variables controlled for in previous models. In Model 1, the effect of both of these variables remained not statistically significant. However, a significant effect of sex does emerge (b = -.235, $p \leq .01$). This effect of sex is driven by the participants in the treatment condition in Experiment 2.[43] When I restrict the analytic sample to only participants who were *not* in the treatment in Experiment 2[44], the effect of sex again becomes non-significant (analyses not shown).

[43] See Tables 13-16 and Figure 9 (and the accompanying text) for a more in-depth discussion of sex differences in responsiveness in participants who were in the treatment condition in Experiment 2.

[44] That is, when the analytic sample contains only participants who were in Experiment 1 or in the control group in Experiment 2.

Table 18. Regression of Cortisol Response on Perceived Level of Status in Group Among Seniors (Experiments 1 and 2), with Senior × Status Interaction

	Model 1 Senior and Perceived Status with Controls	Model 2 Perceived Status X Senior Interaction with Controls
Main Effect		
Senior (Senior = 1)	0.133	0.872*
	(0.088)	(0.336)
Perceived Status	-0.077	-0.012
	(0.047)	(0.055)
Perceived Status × Senior		-0.234*
		(0.103)
Control Variables		
Female	-0.235**	-0.248**
	(0.088)	(0.087)
Caffeine Today	-0.055	-0.052
	(0.075)	(0.074)
Minutes Since Last Meal	0.000	0.000
	(0.000)	(0.000)
Medication	-0.039	-0.035
	(0.090)	(0.089)
On Birth Control	0.032	0.022
	(0.142)	(0.141)
Exercise	0.107	0.136
	(0.190)	(0.188)
Alcohol	-0.028	-0.021
	(0.136)	(0.135)
Non-Prescription Drugs	-0.240	-0.186
	(0.184)	(0.184)
Hours Slept Last Night	-0.003	-0.015
	(0.023)	(0.024)
Typical Sleep Pattern	-0.027	-0.039
	(0.072)	(0.072)
Have Fever	-0.203	-0.194
	(0.331)	(0.327)

Table 18. Continued

First 14 Days	-0.001	0.005
	(0.098)	(0.096)
Smoked in Last Hour	0.027	0.087
	(0.479)	(0.473)
Intercept	0.397	0.280
	(0.236)	(0.239)
R^2	0.13	0.16
N	180	180

NOTE*:* Numbers in parentheses are robust standard errors.

*$p \leq .05$ * (two-tailed) $p \leq .01$ ** (two-tailed)*

Finally, I regressed cortisol response on the dummy variable for whether the participant was a senior, the perceived status variable and an interaction term for the senior dummy and perception of status (Model 2, Table 18). In this model there is a statistically significant interaction between the senior dummy variable and perceived status. The coefficient associated with the interaction term between the senior dummy variable and perceived status indicates that there is a statistically significant difference between seniors and non-seniors in responsiveness to whether the participant perceives himself or herself to be seen as low status in the workgroup (b = -.234, $p \leq$ .05).[45] The negative sign associated with this interaction term indicates that seniors had a higher level of cortisol response than non-seniors—when participants perceived themselves to be low status in the group.

This relationship is depicted in Figure 11[46]. The solid line depicts participants who were college seniors. They are highly responsive, in terms of cortisol, to their own perception of being seen as low status (see solid line on the far left side of the figure). The non-seniors are depicted by the dashed line. In contrast to the solid line (depicting seniors) this line is nearly flat. Non-seniors have virtually no cortisol response to their perception of being seen as either low or high status by other group members.

[45] The results for Table 18, Model 2 are not meaningfully different when controls for all seventeen confederate teams are added to the model (analyses not shown). That is, the coefficient associated with the interaction is statistically significant and in the same direction.

[46] The lines depicted in this figure were computed adjusting for all of the control variables in Model 2, Table 18.

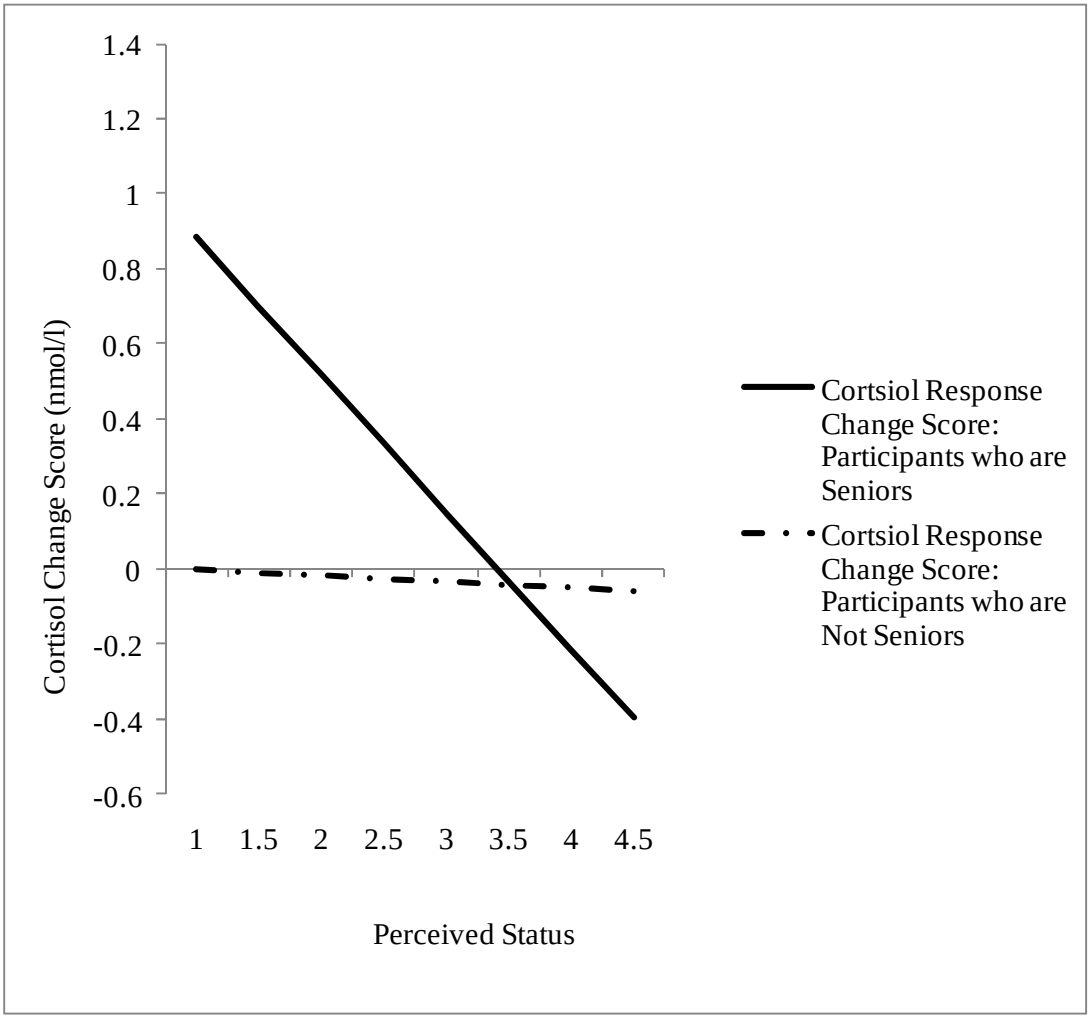

Figure 11: Effect of Perceived Status in the Group with all Controls in the Model, by Senior versus Non-senior

These results are in line with the proposition that actors with a high value of a status characteristic will be more likely to have a cortisol response to a perceived status threat than actors with a low value of a status characteristic. In sum, both seniors and men are more responsive to a perception of being seen as low status in a workgroup than are women and non-seniors. In the following section I build off of these results by trying to extend these results with a final group of participants with a

low value on a status characteristic: African-Americans and Latinos. I expect that these participants will have a relatively low response to a perception of being seen as low status by members of a group with a higher value on a status characteristic (that is, the mostly white confederates).

Cortisol Response to Perceived Status among Latinos and African-Americans

These analyses were used to determine if other groups with a low-value on a status characteristic were also relatively unresponsive to perceived threats to status when they worked with a group comprising members of a group with a higher value of a status characteristic. All participants worked with a group of all white confederates[47] or with a group of three white confederates and one Asian-American confederate. Thus, Latino and African-American participants worked with a group of confederates with a higher value on the status characteristic of ethnicity. In contrast, white participants in this study always worked with a group of confederates with the same value of a status characteristics as themselves (that is, mostly other white students). Thus I expect that neither group should be especially responsive to perceptions of being thought to be low status by other group members. Neither group was defending a taken-for-granted high status among group members with a lower value on a status characteristic (as were men with women and seniors with non-seniors). A key component of my theoretical argument is that it is the disruption of a taken-for-granted status hierarchy that causes a cortisol response in high status actors. Thus, they must perceive the status threat to be originating from *lower* status group members.

In order to test this I again executed several models using the full analytical

[47] There were two women confederates who likely would have identified as Latina as well as white. However, both women likely appeared as white (and not Latina) to most participants.

sample from both experiments. First, I regressed cortisol response on a dummy variable for whether the participant was in one of two categories: 1) was an African-American or Latino or 2) was white.[48] This regression provided no evidence of the effect of being in one of these two categories on cortisol response (Model 1, Table 19).

[48] I dropped all Asian participants and participants who were categorized as "other" from the analytic sample because I have no theoretical prediction as to their response.

Table 19. Regression of Cortisol Response on Perceived Level of Status in Group Among African-Americans and Latinos (Experiments 1 and 2)

	Model 1	Model 2
	African-American or Latino Only	Perceived Status × African-American or Latino Interaction with Controls
Main Effect		
African-American or Latino	-0.011	0.059
	(0.076)	(0.344)
Perceived Status		-0.043
		(0.066)
Perceived Status × African-American or Latino Interaction		-0.023
		(0.106)
Control Variables		
Female		-0.298**
		(0.106)
Caffeine Today		-0.059
		(0.086)
Minutes Since Last Meal		-0.000
		(0.000)
Medication		-0.028
		(0.107)
On Birth Control		0.109
		(0.156)
Exercise		0.107
		(0.183)
Alcohol		0.127
		(0.142)
Non-Prescription Drugs		-0.294
		(0.195)
Hours Slept Last Night		-0.002
		(0.027)

Table 19. Continued

Typical Sleep Pattern		0.006
		(0.079)
Have Fever		-0.359
		(0.438)
First 14 Days		0.010
		(0.113)
Smoked in Last Hour		0.395
		(0.465)
Intercept	-0.010	0.351
	(0.047)	(0.299)
R^2	0.00	0.16
N	132	132

NOTE*:* Numbers in parentheses are robust standard errors.

*$p \leq .05$ * (two-tailed) $p \leq .01$ ** (two-tailed)*

Second, I regressed cortisol response on the dummy variable for whether the participant was African-American or white, the perceived status variable and an interaction term between the ethnicity dummy and the perceived status (with all of the control variables in the model) (Model 2, Table 19). This interaction term was not statistically significant.[49] This interaction term is also not significant without the control variables (analyses not shown). This provides evidence that African-Americans and Latinos and white students (working with white students) are more or less similar in their cortisol response to being seen as low or high status.[50]

This relationship is depicted in Figure 12. This figure provides further evidence that neither of these groups had much of a response at all to a perception of being seen as either low or high status.[51] In the figure, both groups have a relatively flat response across the possible levels of perceptions of status.

[49] Some confederate groups had an Asian-American confederate and some confederate groups had a Latina confederate. Dropping either the teams with the Asian-American confederates, the Latina confederates or both did not change the results presented in Model 2, Table 19.

[50] I also conducted these analyses with a dummy variable which was coded for African-American only vs. White only. That is, I dropped the Latino participants from the analytic sample altogether. The results were not meaningfully different from the results shown in Table 19 and Figure 12. In addition I conducted these analyses controlling for the seventeen confederate teams. Again, the results for these models are essentially that same as those presented in Table 19 and Figure 12. That is, African-Americans and Latinos were not statistically significantly more likely to have a stress response to being in a group of white confederates than were white confederates to being in a group of white confederates, when controlling for which team of confederates with whom they worked.

[51] These means were computed adjusting for all of the control variables in Model 2, Table 19.

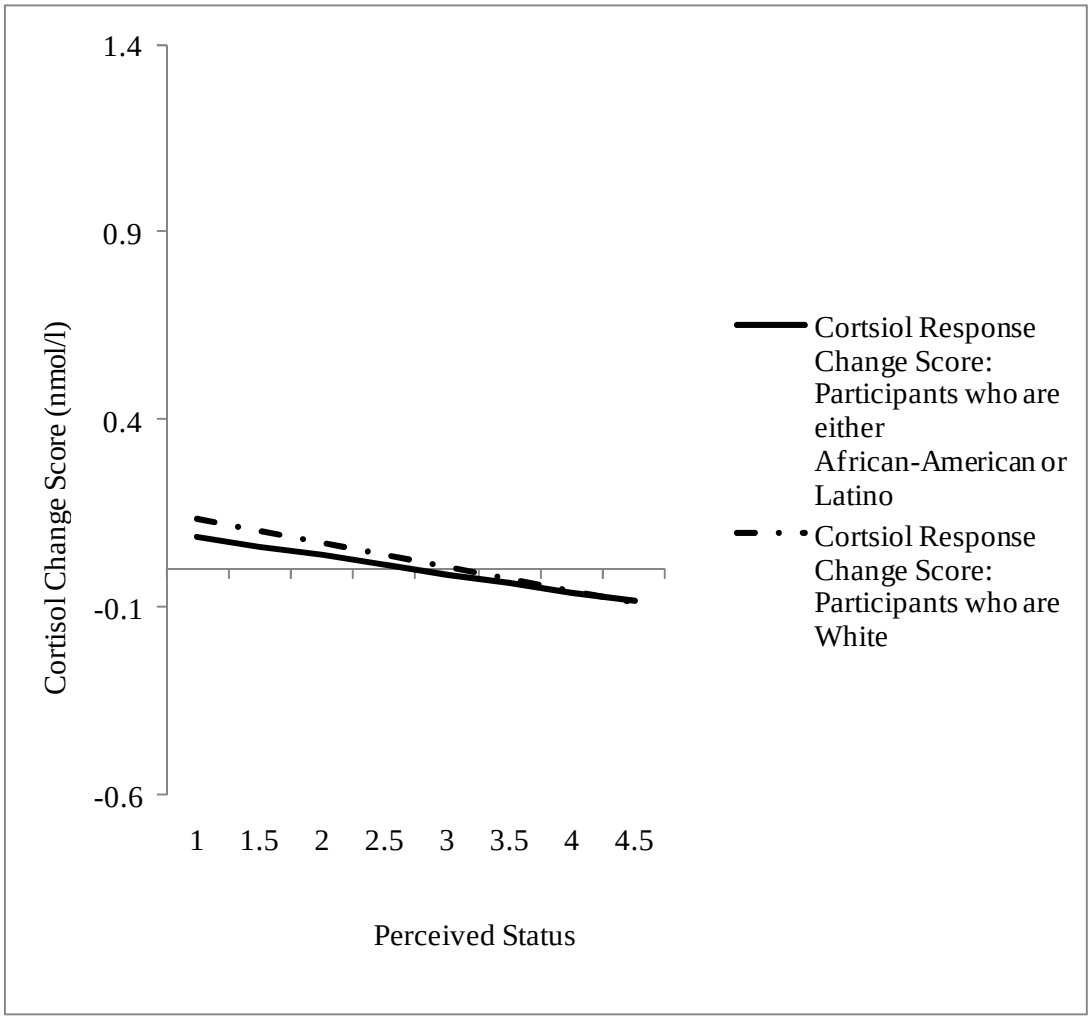

Figure 12: Effect of Perceived Status in the Group with all Controls in the Model, by African-American or Latino versus White

In sum I have provided evidence that groups with a low value of a status characteristic respond very little to a perception of a status threat from members of a group with a high value of a status characteristic. This is in contrast to members of a group with a high value of a status characteristic when faced with a perceived status threat from members of a group with a low value of a status characteristic.

These findings are limited to cortisol response to status threats. And in addition in these analyses they emerge in relatively socially ambiguous settings. However they provide some preliminary evidence that important physiological systems, as well as stress response more generally, may be responsive to threats by lower status group members to a taken-for-granted place in a hierarchy. This may explain work in the sociology of gender literature which finds that men are highly responsive to threats to their status from women. More generally, it may also provide a glimpse into the physiological underpinnings of high status group members' aggressive defense of their high status positions against threats by lower status group members.

CHAPTER 6

CONCLUSION

The findings in this dissertation speak broadly to issues of gender inequality in the workplace and the social status and stress processes that contribute to this gender inequality. In addition I explore themes such as the relationship between status processes, group composition and social inequality more broadly. I use a mix of nationally representative survey data as well as experimental and physiological data to explore the effects of social structures on social interactions. In turn I use this mix of data collection methods to explore the effects of social structures and social interactions on biological processes that can potentially be implicated in the reproduction of social inequality. As such, I turn traditional bio-social models on their head by demonstrating the ways in which the social influences the biological, rather than the reverse. In this way I take a distinctively sociological approach to understanding the relationship between biological and social processes.

More specifically, this dissertation examines the ways in which sex composition impacts people's experiences in the workplace. I examine sex composition at two levels: the occupational level and the level of the smaller work group. Taken together with previous research my findings provide evidence that women encounter negative social environments in male-dominated occupations and workgroups across many different types of occupations, and that these negative social environments can cause a physiological stress response. My findings also provide evidence that women and men are roughly equally physiologically responsive to negative social environments. In addition I find that actors with a high value on a status characteristic are especially responsive to perceived threats to status when in the minority in a group of actors with a lower value on a status characteristic.

Main Contributions

In this project I make five main contributions. First, I show that the effects of sex segregation in the work sector should be examined at multiple levels. Previous work has not intentionally disentangled the effects of sex-composition at different levels. My work shows that this could be a fruitful approach. Study 1 provides evidence that the sex composition of an occupational category alone can establish whether workers will experience effects of being in the minority at the occupational level—regardless of the sex composition of the workers' immediate work environment.

This broad and multi-level conceptualization of minority status also has implications in terms of what can be done at the firm level to create a more hospitable work environment for women who are tokens. For example, many businesses and universities hire women into divisions where there are very few women in an attempt to overcome the token effects described by Kanter (1977) and others (Pierce 1995; Roth 2006). However, Study 1 provides evidence that occupational category itself may be a predictor of perceptions of workplace support. Workplace policies designed to improve the experiences and retention of token women should focus more broadly than on an increase in the number of women in a workplace or firm. Hiring with the intention of creating a sex-balanced occupation is important, but it is not sufficient. Organizations need to also work to create a supportive environment for occupational token women since my findings show that cultural processes at the occupational level may negatively impact negatively social processes at the interactional level. In addition, public policy more broadly should expand its efforts to reduce the sex-integration of occupations.

Study 1 also gives rise to interesting questions that cannot be answered with the MIDUS data. Which matters more in terms of workplace support: sex composition at the firm level or at the occupational level? What do the classic studies of tokens document: firm-level sex-composition effects or occupation-level sex-composition effects (Kanter 1977; Pierce 1995; Roth 2006; Williams 1995)? Future studies utilizing data that contain both occupation-level and firm-level measures could address the question of which factor (occupation- or firm-level sex composition) is more powerfully associated with perceived workplace support. However, in the absence of these data, I have provided evidence that occupational sex composition alone can yield important information about perceived levels of workplace support.

The second contribution I make is to show that the social environments faced by token women can cause a physiological stress response. This type of stress response—a cortisol response—can have real consequences in terms of heath, job satisfaction and mobility, and reproduction of gendered inequality. Again these findings provide evidence that organizations must ensure that they create equal access to positive social environments and social integration for both women and men in male-dominated occupations. Without this attention to social environments token women will likely continue to experience stress response in the workplace and its attendant negative consequences.

The third contribution of this project is that I provide evidence that the stress response exhibited by token women is not due inherent differences between women and men. Rather it is due to the different interactional and structural environments faced by men and women in the workplace. Study 2 provides evidence that women and men both exhibit a cortisol response to being subjected to identical, socially exclusionary treatment.

The results from Study 2 undermine essentialist explanations for the differing

responses token women and token men have to their work environments (Kanter 1977; Pierce 1995; Williams 1995). As noted in Chapter 2, a popular perception is that token women may have a stress response to their social environment because women value social relationships more highly than men. It is argued that this sex difference in the level of importance put on social relationships is based on gender differences in early socialization or sex differences in physiology. In contrast, many sociologists have answered theoretical questions about sex differences in behaviors and experiences as arising from the structural property of group composition. For example, Kanter (1977) convincingly argues that women and men don't report different experiences in management because of inherent sex differences or socialized personality differences, but rather because they are in a different structural position in the workplace—with women as minorities. Other work provides evidence that the statuses of actors interplay with social structures to predict the experiences of minorities. But again, status is given by social structures and interactions, and thus essentialist explanations for observed differences are not the primary focus in understanding the minority experience. Rather, the social context of the individual is a key component to understanding the minority experience. The question arises then: are token women reporting social difficulties in the workplace because they are more sensitive to social slights? Or, are token women actually treated differently? On the average would women and men respond similarly to similar treatment? The findings from Study 2 provide evidence that women and men respond similarly to the conditions to which token women are exposed.

A fourth contribution of this project is the finding that high status actors have more of a cortisol response to a perception of a threat to status in a group than do low status actors, under specific conditions. In particular, in Experiment 2 men and women respond differently to seemingly identical social situations. I argue that the differences

in their responses can be understood by drawing on sociological conceptions of masculinity and status. That is, young men are especially sensitive to threats to status by young women while young women are not especially sensitive to threats to status by young men.

I show that this phenomenon generalizes to other groups as well. Members of groups with a high value of a status characteristic who are in the minority among members of a group with a low value of a status characteristic are relatively likely to have a cortisol response to a subjective perception of low regard by low status others. As such, it seems that such a physiological response might underlie the propensity for high status actors to vigorously defend a status hierarchy that reaffirms their high status. This finding provides also unique empirical support for the idea that young men are especially responsive to threats to masculinity because a threat to masculinity represents a real threat to status. Thus it is cultural understandings of masculinity that may underlie some aggressive behaviors by young men—rather than an innate biological propensity towards violence.

The fifth contribution is that I show that cortisol documents social stress that cannot be assessed by self-report alone. Specifically, this is the case when cortisol is used to measure a stress response to the kind of social experiences faced by token women in the workplace. Importantly, my work shows that cortisol may be more sensitive than self-report measures of stress and anxiety. It may be sensitive to an experience of stress or anxiety among token women that they do not experience at a conscious level or cortisol may be a precursor to consciously experienced levels of stress or anxiety.

Cortisol response may also measure stress and anxiety that token women are hesitant to report to co-workers, supervisors and researchers for fear of professional repercussions—even in cases where they do experience stress response at a conscious

level (Pierce 1995).[52] In the laboratory setting participants did in fact evidence a cortisol response when exposed to the negative social environment which token women experience, despite the fact that subjective measure of stress and anxiety often did not capture this response. In addition theory and empirical evidence concerning the negative social experiences of token women also predict that these experiences *should* cause a cortisol response in the workplace setting (Dickerson and Kemeny 2004; Kanter 1977). Taken together these findings provide evidence that, if anything, token women are actually exposed to higher levels of physiological stress than they divulge to co-workers, supervisors or researchers.

Broad Implications

One broad implication of Study 1 is that a self-perpetuating process may be occurring, in that perceptions of low levels of workplace support likely cause some women to leave high-status, high-paying, male-dominated occupations—contributing further to occupational sex segregation at the national level (Jacobs 1989). A second implication is that women may experience negative consequences whether they are segregated into female-dominated occupations or they join male-dominated occupations. Working in a female-dominated occupation is related to lower pay and status, less control over working conditions, more difficult work, and negative health outcomes (Glass 1990; Reskin and Roos 1990). On the other hand if women are in male-dominated occupations, and consequently experience low levels of workplace support, this may also have negative repercussions.

Low levels of workplace support make it difficult to do one's job well and can

[52] Indeed token women and men who evidenced a cortisol response in the experiment virtually never complained of any stress during the post-experiment de-briefing session with the experimenter.

diminish enjoyment of the work itself (de Jonge et al. 2001). Low levels of perceived support are also associated with negative health outcomes and high levels of stress response (House 1981; House, Landis, and Umberson 1988; Johnson and Hall 1988). Taken together with previous work, this study provides evidence that these problems are likely widespread across many occupations in the United States.

This project then provides evidence that a workplace policy focus on ameliorating the negative social interactions that tokens face could be useful—even if the sex composition of workgroups could not be made more balanced. Taken together Studies 1 and 2 provide evidence that a productive future direction for research and policy would be a focus on the gendered social exclusion and lack of workplace support faced by token women and occupational minority women.

This project also has wider implications in four other areas: economic inequality by sex; women's participation in task-oriented work groups; health outcomes for token women; and understanding social inequality more broadly. First, token women's social stress response in the workplace may be connected to economic inequality between men and women. Women may be more likely to leave male-dominated occupations if they feel that these environments are a chronic stressor due to social exclusion. As such, this may partially help to explain occupational segregation by sex. In turn, occupational segregation by sex is important because it helps to explains economic inequality between women and men (Glass 1990; Petersen and Morgan 1995; Pierce 1995).

The second implication of the findings from Study 2 concerns women's contributions to task-oriented work groups. Women in male-dominated work groups are sometimes hesitant to contribute suggestions to the group because they are aware that they may be seen as an illegitimate member of the group. Even more problematically, even expert women are treated as illegitimate members of male-

dominated work groups (Thomas-Hunt and Phillips 2004; Yoder, Schleicher, and McDonald 1998). Study 2 provides evidence that women may exhibit a physiological stress response to being treated as illegitimate in a male-dominated group. An aversive reaction to this stress response may be a key mechanism in understanding both expert and ordinary women's hesitations to contributing when working in a male-dominated, task-oriented group. This chain of events is plausible because cortisol change in humans has been linked with the kind of social stress that ordinary and expert women often face while working in a male-dominated group or working on a male-typed task (Dickerson and Kemeny 2004; Pierce 1995). Thus, it is important to understand the relationship between social stress and the experiences of token women. A stress response to the social dynamics faced by token women may make it less likely that token women will contribute valuable expertise when working on group problem solving tasks.

Study 2 provides evidence that the negative social environment of token women (for example, gendered social exclusion) is especially problematic. In Experiment 1, participants exhibit a stress response to both gendered social exclusion and being in the minority on the dimension of sex. However, in Experiment 2 the stress response is muted in comparison to Experiment 1. That is, in the absence of gendered social exclusion, token women and men exhibit lower levels of stress response. This finding sheds light on how to interrupt stress processes that result in lower levels of participation for token women. Organizations concerned with maximizing the productivity of decision-making groups can focus on the social environments of token women in order to design and implement policies that are effective for encouraging these women's participation and thus maximizing the human capital of team members.

In addition these findings provide evidence that public policy should address

negative social and interactional processes for token women. To the degree that policy makers want to retain women in male-dominated occupations, it is important to provide equal access to social integration to token women. As noted above, retaining women in male-dominated occupations may decrease occupational segregation by sex and thus decrease economic inequality between men and women. In addition policy makers are concerned about the attrition of trained women workers from occupations in which there is a dearth of qualified workers (such as the physical sciences and engineering). Again, providing access to increased social integration for token women will likely ameliorate this problem by assisting in recent government efforts to retain more women in these fields.

The third implication of this research concerns health outcomes among token women. Chronic exposure to stress—and to chronic exposure to cortisol activation in particular—has been linked with negative health outcomes. I show that the social environment of token women can cause a cortisol response in a laboratory setting. If this cortisol response also occurs in the workplace then it may be linked to negative health outcomes for token women.

Finally, this project can be seen a starting point for more broadly understanding physiological mechanisms which might be implicated in the reproduction of social inequality. The combination of minority status (a structural condition) and gendered social exclusion (an interactional condition) appears to be an especially problematic combination in terms of stress response. In addition it is a combination that is often confounded outside of the laboratory and for many minority groups. For example, African-Americans are both in the numerical minority and often encounter racism. Likewise gays and lesbians are in the numerical minority and often encounter homophobia.

Some have argued that micro- and macro- processes can be seen as

intertwined, with each level impacting the other (for example, Coleman 1990; Fine 1993). As such, there may be important feedback loops between individual level physiological responses and social structures and interactions. The physiology of an individual can respond to socially meaningful signals from the social environment. This physiological response then effects the actions of the individual and the actions of the individual may help to reproduce social inequality. For example, I provide evidence that if a token woman is excluded from conversations in a way that makes her lower social status especially salient her HPA axis is activated and cortisol levels will increase. This physiological arousal may incline her towards an avoidance of the stress-inducing situation. This type of "flight" response to physiological arousal is well documented (McEwen 1998). And the token woman's attempt to avoid the stress provoking situation may result in her leaving the job or being less engaged in the job. Either exit from her job or decreased workplace engagement would contribute to the maintenance of occupational segregation by gender. And occupational segregation by gender is an important cause of the gender gap in wages between men and women—a key cause of social inequality between women and men. In this way social structure and interactions can be seen as affecting the body through physiological stress response. And in turn the interaction between individual biological response and social structures and interactions might interact to re-create structures of inequality.

Study 2 provides a close examination of one example of the relationship between sociological phenomena and cortisol response. Gendered social exclusion does cause a cortisol response in a laboratory setting. This project also provides further evidence that negative social processes can be associated with group composition at both the macro- and micro- levels. The findings from these studies also have implications beyond gender inequality and for a range of physiological responses. Stress response may also occur among other minority group members who

are routinely exposed to negative social treatment (for example, racism, classism or homophobia). For example, some African-Americans report being subjected subtle racism on a day-to-day basis and therefore might also be exposed to chronic stress (Feagin 1991). A greater understanding of the processes that activate physiological responses may more broadly inform sociological research concerning social inequality. Thus my research on the relationship between gender, token status and cortisol reactivity can provide a beginning point for examining the relationship between socially important characteristics of many kinds (for example gender, race, ethnicity, nationality or sexual orientation) and physiological reactivity in a variety of social environments. Further work should be done to understand better how the physiological responses to social environments might interact with, and reproduce, social inequality.

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